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REPORT

OF A

COMMITTEE APPOINTED BY THE

CLINICAL SOCIETY OF LONDON

TO INVESTIGATE THE

PERIODS OF INCUBATION AND CONTAGIOUSNESS

OF

CERTAIN INFECTIOUS DISEASES.

SUPPLEMENT TO VOLUME THE TWENTY-FIFTH.

26949
8/5/93

LONDON:
LONGMANS, GREEN, AND CO.
1892.

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INTRODUCTION.

IN 1878 the Clinical Society of London appointed a Committee to investigate the periods of incubation and contagiousness of smallpox, scarlet fever, typhus fever, diphtheria, enteric fever, erysipelas, varicella, mumps, and other communicable diseases. The subject had been brought to the notice of the Society by the late Dr. Murchison in a paper entitled "Observations on the Period of Incubation of Scarlet Fever, and of some other Diseases" (*Transactions*, vol. xi, p. 238).

In response to a circular then issued a certain amount of valuable material was received by the Committee, but it was thought desirable to defer the presentation of any report until further experience was available.

In November, 1888, the Committee was reconstituted, and a new circular letter was prepared, asking for particulars of cases which might throw light on the periods of incubation or of contagiousness of the zymotic diseases commonly observed in the United Kingdom. This letter was sent to many medical officers of health, as well as to a number of gentlemen practising in the more sparsely populated parts of the country, who it was thought, in view of their remoteness from large centres of population, might have peculiarly favorable opportunities of tracing the source and progress of infection. The letter was also published in the medical journals.

A large number of replies were received in response to this second letter, and in addition thereto Sir George Buchanan allowed his complete collection of reports made to the Medical Department of the Local Government Board since 1878 to be examined; extracts from reports of earlier date had already been made by Sir G. Buchanan himself. The material thus obtained has been arranged, condensed, and tabulated in the following pages. Every case which appeared in any way to throw light on the points which the Committee was appointed

to investigate has been reproduced, as far as possible in the writer's own words.

The diseases as to which the Committee finds itself in a position to report are the following:—Smallpox, varicella, measles, rubeola, scarlet fever, influenza, whooping-cough, diphtheria, enteric fever, mumps.

A separate section is devoted to each disease. For convenience of reference the sections are not arranged in the above natural order, but in alphabetical sequence.

The majority of the cases contained in the report are new. In a few instances the histories had been published in the medical journals or elsewhere before being sent to the Committee; many of those received from medical officers of health had been published in their annual reports, which, however, are not documents easily available for reference. Most of the cases reported to the Local Government Board have been published in its special reports, and a few in the Annual Reports of the Medical Officer. It must, however, be clearly understood that there has been no attempt to collect the published literature of the subject. On the contrary, it was the desire of the Committee to bring forward original matter for the elucidation of a subject of considerable practical importance. The introduction prefixed to each section contains a summary of the cases, and is founded entirely on the histories communicated to the Committee, with the addition of the cases reported to the Society by Dr. Murchison in the paper which originally led to the appointment of the first committee. The histories are, it is believed, given with sufficient fulness to enable the reader to form his own estimate of the value of the evidence adduced in each case. In the introduction to each section an attempt is made to indicate the relative value of this evidence.

As was inevitable from the method followed, the amount and character of the material to be dealt with in respect of each disease varied very greatly. Thus under diphtheria and scarlet fever, for instance, the histories received are probably superior not only in number, but in value, to any which exist elsewhere; whereas in certain other diseases—as, for example, whooping-cough—the number of cases sent in was small, and the histories not very conclusive.

The term "period of incubation" has been taken in its ordinary sense, to mean the interval between exposure to a source of infection, and development of the earliest recognisable symptoms. During this interval the most careful clinical examination commonly fails to reveal any departure from the

standard of health, but this is not always so. The occurrence of ill-defined signs of illness before the onset of the characteristic symptoms sometimes renders it extremely difficult to settle with precision the date at which the disease should be reckoned to have begun. In enteric fever, for instance, complaint is sometimes made of malaise and other indefinite subjective symptoms for some days before the onset of recognisable signs; again, in measles a fugitive initial fever may sometimes be noted, while in diphtheria it probably happens not infrequently that the specific infection is preceded by a non-specific inflammatory disorder of the throat. The special possibilities of error from such sources are discussed under the head of each disease.

Trousseau,* in a well-known passage in his lectures, said:

"Nothing is more difficult than to state the exact time at which contagion has been contracted in an exanthematous fever, when the virus has not been directly introduced by inoculation. . . . According to some the incubation of scarlatina varies in duration from three to five days, according to others it lasts for eight days, and some believe that it may be prolonged to fifteen, twenty, or even thirty days. In fact, the figures given have been hypothetical. There exists an unwillingness to admit the fact that it is impossible to determine the duration of the period of incubation, just because it is impossible to fix the date of its commencement."

This objection, as he himself admits elsewhere by implication, does not apply to cases in which the evidence shows that the person infected was exposed to the source of infection for a few minutes or hours only. Such cases, therefore, possess a special value, and in the following pages have been arranged in special tables and discussed separately, when their number warranted such a course. They have been, in fact, made the basis of the conclusions drawn as to the duration of incubation, while other histories, in which only the date of the commencement or cessation of exposure to a source of infection was given, have been used for contributory evidence. A case in which exposure has been prolonged, but in which the date of the commencement of symptoms is known, may afford evidence of a period of incubation unusually short; while a case in which the exposure was continuous down to a certain date, but ceased at that date, may furnish an example of an incubation period unusually long.† It

* New Syd. Soc. translation, vol. ii, p. 163, *et seq.*

† It may possibly be objected that too much space and importance has been given to the evidence afforded in the case of certain diseases by the history of school epidemics. While it is true that the gathering together in a school of a

should be noted, however, that in certain diseases—in diphtheria, for instance, and perhaps in measles—there is some evidence that continuous, *i. e.* prolonged exposure to a source of infection appears to tend to shorten the period of incubation.* The cognate suggestion, that the period of incubation in enteric fever is shorter when the "dose" of infective material introduced into the system is larger, has also been noted; but ground sufficient for a full discussion of these points, which are perhaps rather of theoretical interest than practical importance, is wanting in the cases communicated to the Committee.

In the calculation of percentages, which has been done in most cases as a matter of convenience, the nearest whole number has been taken. The adjective "diphtherial" has been systematically used to express the specific process due to the disease diphtheria, the term diphtheritic being used for other inflammatory processes not due to true diphtheria.† This statement does not, however, apply to quotations within inverted commas.

The Committee is much indebted to the numerous gentlemen who have contributed cases and reports, and who have in many instances been at no little trouble to verify all the circumstances, and to answer inquiries addressed to them when additional particulars were desired.

The Committee has especially also to thank Dr. Clement Dukes, who read the proofs of the sections dealing with Mumps and German Measles, and Dr. Birdwood, the Medical Superintendent of the Smallpox Hospital ships of the Metro-

large number of susceptible individuals, with many opportunities of intercommunication, is a source of possible error of observation, yet in a large public school, with a good sanatorium and a vigilant medical officer, a case is generally recognised at the earliest possible stage, and isolation and disinfection are carried out with great care. In consequence it frequently happens, at any rate in smaller, or at the beginning of more serious epidemics, that the interval between the cessation of exposure and the onset of symptoms can be determined with great accuracy.

* Dr. Birdwood (*Guy's Hospital Reports*, xlviii, p. 102), on the other hand, believes, "that length of exposure to infection has a great deal to do with the severity or mildness" of an attack of smallpox, but does not affect the duration of the period of incubation. He brings forward evidence to show that "successive sowings of spores result in successive crops of pocks. If some patients happen to have been exposed for a short time only, the eruption on that particular part will all, or almost all, appear on one day. If others are exposed from day to day, crops of pocks continue to come out for three or four days."

† This restriction of the terms is in accordance with a suggestion made by Dr. Donald Macalister (*Practitioner*, vol. xliii, p. 123). Its general adoption would undoubtedly avoid much ambiguity.

politan Asylums Board, for a like kind service in respect of the section on Smallpox.

The Report has been prepared for publication by Dr. Dawson Williams, one of the Honorary Secretaries of the Committee.

Note by Dr. Broadbent.—The Committee are bound as a simple matter of justice to call attention to the important part which Dr. Dawson Williams has taken in collating, sifting, and arranging the large amount of material embodied in the Report. It is due mainly to the enthusiastic interest he has taken in the question, and to the labour he has devoted to the investigation, that the Report can now be placed before the Society, and the Committee consider that he deserves the special thanks of the Society.

COMMITTEE.

The members of the Committee, as reconstituted in 1888, *were—*

W. H. BROADBENT, M.D., *Chairman.*

SIR GEORGE BUCHANAN, M.D.
WILLIAM CAYLEY, M.D.
THOMAS BARLOW, M.D.
ALFRED HILL, M.D.
ISAMBARD OWEN, M.D.
R. THORNE THORNE, M.B., C.B.
ALDER SMITH.
R. W. PARKER.

Honorary Secretaries.

SHIRLEY F. MURPHY.
DAWSON WILLIAMS, M.D.

REPORT.

DIPHTHERIA.

IN attempting to ascertain the periods of incubation and infectiousness in diphtheria certain special difficulties are encountered, or rather certain difficulties which exist in the cases of several other infectious diseases are found to be specially great. In the first place, it is not always possible to fix the exact time at which the specific process begins. In the second place, in certain epidemics of diphtheria a large proportion of the cases are of so mild a character that the disorder is considered to be "simple sore throat." Among the notes and reports which follow are many instances in which an epidemic of diphtheria has been started or kept up by cases so mild that medical advice was not sought, or so anomalous that, in their earlier stages at least, a correct diagnosis was impossible, or was not made. For this reason, cases which appear to show that the incubation period of diphtheria may be prolonged very much beyond that which the bulk of the returns show to be the average ought to be very carefully scrutinised. In the third place, the fact, now well established, that diphtheria may be conveyed by milk has to be constantly borne in mind.* From this last source of error, however, the reports made to the Local Government Board, and communicated to the Committee by Sir George Buchanan, are, as a rule, free.

Incubation Period.

If the cases in which the disease is stated to have been contracted by a single exposure to infection for a definite short period (see Table I) be first considered, it will be seen that in 17, or 63 per cent., the period of incubation was four days or less, and that in all but one it was seven days or less.

In twenty-three instances the exposure to the source of

* See Mr. Power's concluding remarks in Report xxxix.

infection ceased on a given date; it will be seen from Table II that the interval between the cessation of exposure to infection and the development of the disease was in eleven instances, or 48 per cent., four days or less, and in eighteen, or 78 per cent., seven days or less.

In twenty-one instances the infected person was exposed to infection at and after a given date. It will be seen from Table III that the period from the commencement of the exposure to the development of the disease was four days or less in eleven cases, or 52 per cent., and was seven days or less in seventeen, or 81 per cent.

Combining Tables I and III, we have 48 cases in which the dates at which exposure to infection commenced, and the disease commenced, are known. The periods of incubation in this series of 48 cases cannot have exceeded the intervals between the two dates above defined, though in a certain portion, viz. the 21 cases in Table III, they may have been less. It will be seen that in 28, or 58 per cent., the period of incubation cannot have exceeded four days; while in 43, or 90 per cent., it cannot have exceeded seven days. In 4 other cases, viz. Nos. 9, 24, 51, 13 (Table II), the dates at which exposure to infection commenced, and the disease commenced, are also known; adding these to the 48 previously mentioned in this paragraph, we have 52 cases in which the periods of incubation cannot have exceeded the intervals between these two dates. In 30, or 58 per cent., the period of incubation cannot have been more than four days; while in 45, or 87 per cent., it cannot have been more than seven days.

These figures point strongly to the conclusion that the period of incubation in diphtheria comparatively seldom exceeds 7 days.

In Table IV are brought together all the cases in Tables I, II, and III which best stand the test of criticism; that is to say, the statements as to the date and other circumstances of infection may probably in these 32 cases be accepted as accurate. In these cases the period of incubation cannot have exceeded four days in 16, or 50 per cent., and cannot have exceeded seven days in 27, or 84 per cent.

If the instances in which the period of incubation is believed to have been prolonged considerably beyond seven days are separately examined, it will be seen that in none is the evidence entirely conclusive. In Case 72 (Report xlvi) Dr. Parsons merely says that "it was locally believed that the period of incubation was fourteen days." He is unable to

give the dates, and evidently does not himself attach much importance to the case.

In Case 10 (Report iv) Dr. Ogle is only able to give the mother's "most positive" statement that the child's illness commenced eleven days after the last exposure. In Cases 17 and 18, children discharged from a hospital in which diphtheria was prevalent were attacked nine and fourteen days respectively after leaving the hospital. It does not, however, appear to have been proved that they were not exposed to infection from some other source in their own homes or elsewhere. In Case 3, reported by Dr. Bruce Low, the suggested period of incubation—five weeks all but two days—is so exceptional, that it is doubtful whether it ought to be accepted in the absence of any evidence from other cases of periods even approximating to thirty-three days. The infection can be preserved in fomites, and it is not impossible that it may have been so preserved in this case in clothes which were only taken into use when the weather became colder.

The relative frequency with which the disease began, after a single exposure, on each day from the 2nd to the 7th may be exhibited in the following rough table, in which the tabular numbers of the cases are arranged under the various days.

Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.
19					
25					
32					
36		23			
37	41	29			
52	30	21	83	46	48
54	45	51	31	47	72
74	77	75	69	64	65

Dr. Murchison does not give any cases throwing light on the period of incubation in this disease, but quotes Oertel to the effect that "it may be stated positively to occupy from two to five days." The cases above tabulated appear to show that the period of incubation is most commonly two days, that it is not infrequently three or four days, and that it is sometimes extended to six or seven. The evidence for a latent period beyond seven days is in no case conclusive, and if such an extension does ever occur it must be only in rare instances. That the period does vary, even when all the circumstances are very similar or nearly identical, appears from several of the reports quoted below; the most striking instance is the occurrence reported by Dr. Parsons (lii).

TABLE I.—*In the following cases there is evidence that the disease was contracted by a single short exposure.*

No. of case.	No. of report.	Period of incubation.	
19	vii	2 days	Possibility of previous exposure does not seem to have been entirely eliminated.
25	xii	„	History not incompatible with a long period, *i. e.* 11 days at least.
30	xvi	57 hours	
32	xvii	2 days	Possibility of previous exposure not entirely eliminated, but the cases lived in different hamlets.
38	xviii	„	Possibility of previous exposure not entirely eliminated.
39	xviii	„	
53	xxix	„	Dates are not stated; information obtained some time after occurrences.
56	xxxii	„	There had been previous unrecognised cases in the town.
76	lii	„	
41	xix	2 or 3 days	Dates not stated; information obtained some months after occurrences, but probably approximately correct.
46	xxi	3 days	
79	liii	„	
23	xii	3 to 4 days	
29	xv	3 or 4 days	Dates not given, but statement probably approximately correct.
21	ix	4 days	
52	xxv	„	Possibility of previous exposure not eliminated. History compatible with a longer period.
77	lii	„	
31	xvi	5 days	
71	xliii	„	
83		„	
47	xxii	6 days	Cases doubtful owing to almost simultaneous attack in another member of the family who was not exposed to the assumed source of infection.
48	xxii	„	
66	xl	„	
49	xxii	7 days	Same remarks apply as to 47 and 48.
74	xlviii	„	
67	xl	„	Doubtful (?), as source of infection was not certainly traced.
72	xlvi	14 days	Reporter says that it was "locally believed" that incubation had lasted 14 days.

TABLE II.—*In the following cases exposure to the source of infection ceased at a known date.*

No. of case.	No. of report.	Interval between cessation of exposure and attack.	Interval between commencement of exposure, when stated, and attack.	
9	iii	2 days	4 days	
24	xii	,,	,,	
27	xv	3 days	—	
33	xvii	,,	—	
34	xvii	,,	—	
51	xxiv	2 days	8 days	
13	v	3 days	9 days	
42	xx	4 days	—	
43	xx	,,	—	
44	xx	,,	—	
81	liii	,,	—	
20	viii	5 days	—	
35	xvii	,,	—	
61	xxxviii	7 days	—	Possibility of subsequent exposure not completely eliminated.
62	xxxviii	,,	—	
63	xl	,,	—	
64	xl	,,	—	
82		,,	—	
78	liii	8 days	—	Doubtful, as communication may have subsequently occurred between the two sections of the family.
17	vi	9 days	—	? as to condition at home; ? fomites.
10	iv	11 days	—	Mother's statement only.
18	vi	14 days	—	Dates not given; ? as to condition at home; ? fomites.
3		33 days	—	? fomites.

TABLE III.—*Cases in which the individual was exposed to infection at and after a known date, showing the number of days after the commencement of such exposure at which the disease began.*

No. of case.	No. of report.	Interval between commencement of exposure and attack.	
54	xxxi	1 day	Infection may have been derived from some other unrecognised source.
55	xxxi	,,	
50	xxiii	2 days	
22	x	,,	
68	xlii	2 or 3 days	
40	xix	3 days	
6	ii	4 days	
8	ii	,,	
11	v	,,	
80	liii	,,	May have been previous exposure.
45	xxi	,,	
14	vi	6 days	
26	xv	,,	
65	xl	,,	
5	ii	7 days	
7	ii	,,	
70	xlii	,,	
28	xv	8 days	
12	v	9 days	
15	vi	13 days	
16	vi	14 days	

TABLE IV.

TABLE I.

No. in schedule.	Days of incubation period.
30	3 days less than
38	2 days
39	,,
76	,,
46	3
79	3
23	3 or 4
21	4
77	4
31	5
71	5
83	5
66	6
74	7

TABLE III.

No. in schedule.	Days of incubation period.
50	2
40	3
6	4
8	4
11	4
45	4
14	6
26	6
65	6
5	7
7	7
70	7
28	8
15	13
16	14

TABLE II.

No. in schedule.	Days of incubation period.
9	4
51	8
13	9

Duration of Infectious Period.

The cases throwing light on the duration of the period of infectiousness have been brought together in the following tables.

Table V contains a number of cases in which the individual who infected others was either convalescent or was supposed to have completely recovered. In some instances the patient was suffering from paralytic symptoms, in others there was sore throat or discharge from the nose, but in others the patient is not known to have presented any symptoms whatever. Excluding cases of so-called chronic diphtheria, it will be seen that the interval between the acute attack and the time at which the patient infected others varied from a few days to two and a half months. Dr. Gresswell has brought forward evidence to show that in certain persons a single attack of the disease leaves a peculiar liability to suffer from repeated attacks, and that such patients during these subsequent attacks are capable of infecting others with typical diphtheria; further, in certain cases he believes that such a patient may be infective though not obviously suffering from any acute or subacute symptoms. In some instances it has even seemed that the power of a patient to transmit infection to others went on increasing for some week or two after the commencement of convalescence. The reports afford evidence also that infection can be derived from the body of a person dead of diphtheria (*see* xxxii, xxxvii, and Case 83).

Table VI contains the cases in which the individual who is believed to have infected others was in the incubative or very early stage of the developing disease. The cases are few in number, and in all, with the exception of Case 23 (xii) and possibly of Cases 11 and 12 (v), the patients were already suffering from sore throat or were "sickening." In one case (Case 37, Report xviii) it appears that the patient, who was brought into contact with eighty-six children of susceptible age four days before her attack, was not then infective. In his report on an epidemic at Sculcoates (Report iii) Dr. Blaxall observes that it was "noteworthy that the infection would appear to have been disseminated by sufferers in the incubative and acute stages of the disease;" and in a report on diphtheria at Farnham Mr. R. D. R. Sweeting states that "suspicion of early infectiousness of the disease in its pre-exudative stage was also afforded."

TABLE V.—*Examples of infection conveyed by individuals during convalescence, or after supposed complete recovery.*

Report.	Condition of infector, or interval of time after attack commenced in infector.
ii.—Case 5 . . .	27 days.
ii.—Cases 6 and 7 .	26 days.
ii.—Case 8 . .	21 days.
vii.—Case 19 . .	Convalescent.
x.—Case 22 . .	25 days.
xi.—Case of governess .	"A week or so" after discharge from hospital.
xii.—	Convalescent, but had offensive discharge from nose. 2 weeks after discharge from hospital.
xiv.—Case of C. T. .	3 or 4 weeks or more. Paralytic symptoms.
xiv.—Case of Oct. 11th .	About 4 weeks. Convalescent.
xv.—Case of A. . .	About 5 weeks. "Well."
xv.—Case of E. M. . .	Convalescent.
xvi.—Case of boy aged 6 .	Convalescent.
xvi.—Case 31 . . .	3 weeks after attack.
xvii.—Case of B. and others	About a month.
xvii.—Case of Albert . .	More than a month.
xix.—Case of G.'s daughter	Convalescent from unrecognised diphtheria; voice affected, glands of neck swollen.
xxiv.—	About 4 or 5 weeks; convalescent, but had sore throat.
xxvi.—Case of M. . .	A month or more; convalescent, but had sore throat.
xxvii.—	Returned to school with debility, weakness of vision, and peculiar voice; 38 days after attack.
xl.—Case 65 . . .	3 weeks; convalescent.
xl.—Case 66 . . .	2 or 3 weeks; convalescent. Short interview in open air.
xlii.—	Paralytic symptoms only noticed.
xlvi.—	$2\frac{1}{2}$ months.
liii.—	Just recovered; throat sore.

TABLE VI.—*Examples of infection apparently conveyed in incubative or very early stage of disease.*

Report.	Condition of infector and duration of exposure.
v.—Case 11.	The three days before infector was taken ill.
v.—Case 12.	The three or four days before infector was taken ill.
xii.—Case 23.	Short interview and kissing in open air; day before diagnosis of diphtheria; infector able to attend school.
xii.—Case 24.	For two days preceding diagnosis of diphtheria (sore throat during this period).
xv.—Cases of J. W. and H.	Infector attended same school up to time of sickening.
xv.—Cases of three children infected by H.'s sister.	This case is of very questionable value, as the children had been at school with H.
xvii.—Case of A. G.	Five days before "white patches were seen," but a few days after suffering from ordinary cold, and on day of vomiting.
xxi.—Child ceased attending school owing to severe sore throat.	Three cases of diphtheria and four of sore throat four days later.
xli.—Case of C.	Attended same school up to developed attack.

Sore throat and unrecognised diphtheria.

The reports quoted in the following pages afford many instances in which the infection of diphtheria was conveyed by persons who themselves were not known to have suffered from the disease. These instances appear to belong to two categories: in the one the person who conveys the infection has suffered from a sore throat not recognised as being diphtherial, in some cases even after medical examination; in the other the individual has not suffered from any throat affection, nor from any other obvious disease. This has been very clearly put by Dr. Airy in paragraphs 5 and 6 of his report, here numbered v.

Without attempting to enter on a discussion of the pathological nature of these cases of obscure sore throat followed by diphtheria in the same family or school, it may be well to indicate the clinical varieties in connection with which this event has been observed.

In the first place it seems probable that in many instances the sore throat is clinically a mild but recognisable form of diphtheria. Many instances might be quoted in proof of this. Dr. Blaxall, in his *Report upon the Long-continued Prevalence of Diphtheria in the U. S. D. of Taunton* (September 6, 1883), speaks of the concurrent testimony among all classes as to the general and continued prevalence of sore throat throughout the town. "It was," he adds, "no uncommon thing to hear from infected families that prior to their own attack their friends or neighbours had suffered from sore throat; and upon my making inquiry of these latter persons it appeared that their illness had been of so mild a character that no medical man was consulted. At the same time, from the particulars they gave me, I was satisfied in my own mind that in some instances the nature of the illness from which they had suffered was diphtheria." As an example he quotes the case of two children whose mother stated that she observed white patches in their throats, and that afterwards their voices were much affected, and their eyesight very bad, insomuch that "the little girl could not see to thread her needle."

Dr. Parsons, in a report on diphtheria at Roche and St. Stephen's, Cornwall, writes: "I learnt from more than one source that sore throats were very prevalent in Roche last autumn. Thus the schoolmaster at the Roche Board school states that at the time when diphtheria was prevalent, and to a less degree before and afterwards, many of the school

children had sore throats, and used to come to school with their necks tied up in flannel. Experience gained elsewhere has shown that outbreaks of diphtheria are frequently accompanied by a similar prevalence of sore throats not distinctly diphtheritic in character, and has shown it to be probable that though such cases may not, from a clinical point of view, come within the definition of diphtheria, they are essentially of the same nature, and that a susceptible person coming in contact with one of them may contract the disease from it in a severe form." Further on he states, "In September, 1887, diphtheria broke out in five households in Nanpean and Currian, the first case in each being a child attending the Board school at Nanpean, and most of them being in the same class. Four out of the five children were cousins, and used to meet elsewhere than at the Board school. The schoolmaster informs me that about that time a number of children at the school had sore throats; indeed, two of his own children suffered, and one had to keep his bed for two days. The medical man who saw the schoolmaster's children tells me that they suffered from ordinary inflamed sore throats, not diphtheria. I saw at Currian in one household a girl with decided diphtheria, and a sister suffering from quinsy, a single tonsil being much swollen and inflamed, but without any diphtheritic exudation. In another family at Currian I found three children all suffering from sore throat, but without any of the characteristic appearances of diphtheria."

In this connection the observation made by Mr. Spear (Report xx) is of great interest; seven children were infected on the same day by the same case of severe sore throat; all seven were taken ill with fever and sore throat four days later, but in three only was the throat affection distinctly diphtherial. In another epidemic reported on by Mr. Spear (Spilsby, May, 1885) a child died of diphtheria on June 7, 1883. The next case of unequivocal diphtheria was a child who sickened on November 13, but in the interval there had been in the neighbourhood numerous cases of sore throat. Mr. R. D. R. Sweeting, in a report on diphtheria in Herefordshire (1886), states that "minor sore throat existed in families coincidently with true diphtheria, and in some cases a trivial throat affection appeared to give rise by direct infection to severe and fatal diphtheria. Again, cases deriving infection from a common source showed some membrane, others none at all; the latter cases suggest the existence of an abortive form of diphtheria, analogous to that of smallpox without eruption."

The same inspector observes as to an epidemic at Tottenham, "'sore throat' often preceded and followed diphtheria in the same house and family, appearing to act as a link to undoubted cases of diphtheria." In reference to an epidemic at Cheshunt (1885), he states that the epidemic was mainly spread through the school. During December, 1884, and January, 1885, numerous cases of "simple sore throat" occurred among the school children. Such children returned to school in various stages of convalescence. The first recognised case of diphtheria occurred on February 7, and a series of cases followed among the school children. "It can hardly be doubted, therefore, that in this instance, as in other similar ones that are recorded, a malady that was known only as a simple sore throat had the sudden ability, when introduced into the school, of producing amongst the attendants at that school severe and fatal diphtheria."

The importance of this question in connection with the subject-matter of this report is further exemplified by the following remarks made by Mr. W. H. Power in writing in 1883 (*Report to the L. G. B. on Diphtheria in Pirbright, and on the Influence of the School there in the Behaviour of the Disease*) :—"Not infrequently severe and fatal diphtheria appeared destitute or well-nigh destitute of power to infect other children living along with it while, on the other hand, cases of very trivial sore throat or 'colds;' that were not perhaps heard of (except by close questioning), often preceded and were seemingly responsible for after occurrences of true and fatal diphtheria in the family. Especially was this apparent capacity of mere sore throat for breeding malignant diphtheria noticeable in regard of families comprising many young children. In such families severe or fatal cases of diphtheria tended to occupy a position midway in a series of attacks that began as sore throat and ended in similar fashion. And further, we got a suspicion, though the instances were too few to justify any conclusion thereon, that, given the occurrence about the same time of two or more cases of trivial sore throat among children of a large family, such occurrence was likely to be quickly followed by severe diphtheria attack in one or more children of that family."

Numerous other instances of the endemic prevalence of "sore throat" with occasional cases of recognised diphtheria might be given, and a few will be found in the following pages. The circumstances which determine the clinical characters cannot be discussed here, but frequently, as in the epidemics

recorded in Reports xxxiv, lvi, lvii, lx, the gravity of the disease would appear to depend upon the presence or absence of gross sanitary defects in the houses of the individuals exposed to infection.

The clinical characters of the sore throat which may be observed in connection with epidemic diphtheria appear to vary a good deal; Mr. Spear has written on this point at some length in the report from which an extract will be found below (see Report xliii). Follicular tonsillitis, suppurative tonsillitis, chronic tonsillitis with chronic enlargement of cervical glands, and quinsy are among the terms which have been used with more or less frequency.

Diphtheria and scarlet fever.—In some epidemics true diphtheria has been associated with an epidemic of true scarlet fever; that is to say, the two diseases have been present in the same village at the same time, and the members of the same family have suffered some from one, some from the other, and some first from one (generally diphtheria) and then from the other. Under such circumstances it becomes practically impossible to disentangle the history of separate infection, and it often appears as if the one disease had been produced by the other. The reports here numbered liv, lv, lvi, lviii, xlvii, and xvii, especially if read in the order indicated, will illustrate the difficulty, and at the same time afford evidence of the correctness of the view above expressed. It appears, further, that in some instances a membranous sore throat may complicate scarlet fever, and imitate very closely the clinical features of diphtheria. An example of such an occurrence is afforded by the epidemic which is the subject of the report by Dr. Parsons here numbered lvii.*

Fomites.

There is good evidence that the infection can be conveyed in clothes and retained in them for considerable periods. Report xvi contains an instance in which soiled linen appears to have preserved the infection in a most virulent state for a month or more; in Report xxxiii mention is made of an instance in which the infection was believed to have been preserved in clothes for four months; in another epidemic (Report xl) it appeared highly probable that a family, which had escaped at an earlier date, was infected by clothes which

* This subject may be pursued in Dr. Thorne Thorne's recent work on *Diphtheria: its Natural History and Prevention*, London, 1891, p. 63, *et seq.*

had belonged to children who had died of the disease about seven months earlier. Dr. Parsons (Report xlix) records an instance in which in two households outbreaks of diphtheria followed the use of a bed, given by a neighbour, upon which a patient suffering from diphtheria had slept. An interesting example of persistence of infection in a house is to be found in Report xvii, the retention of infection being apparently due to imperfect preparation of a bedroom for disinfection. A somewhat similar but longer history is related by Dr. Gresswell (Report xxv); in this case diphtheria appeared again and again among the servants of a farmhouse after spring or autumn "cleaning."

Conveyance of infection by persons who did not suffer.

Turning now to the examples of conveyance of the infection by persons who have not themselves suffered from illness of any kind in the interval, it will be found that in the majority of the cases the person who thus conveyed the infection was at or about the time engaged in nursing patients in the acute stage, or was otherwise in intimate contact with such patients. The evidence, however, in many of the cases is far from being conclusive, and amounts only to strong probability. Report xii contains an example: three children were removed from an affected house, and had no contact with the rest of the family for nine days; then the grandmother, who had not had sore throat nor any symptoms of diphtheria, but had nursed two of the cases ill in her house, called and saw the three isolated children; she kissed one of them, and this child was attacked by diphtheria two days later (Case 25). In Report xvi an instance is noted in which it was thought probable that an elderly woman, who had on several occasions gone to an infected house to nurse children suffering from the disease, was the means of conveying the infection to her daughter, although she did not herself suffer from the disease. A more convincing case is related in the second paragraph of the abstract of one of Dr. Blaxall's reports (xix): a mother who did not suffer from diphtheria, but who was nursing one of her own children suffering from an early stage of the disease, visited a friend who lived five miles away, and took an infant in her arms for a short time; this infant was attacked two or three days later; no other source of infection could be traced. Report xxxi contains two instances in which

it seemed probable that the infection was conveyed by persons who were in more or less intimate contact with patients ; in the one case the conveyer of the infection actually slept with a patient, but in the other the symptoms in the person from whom the infection was supposed to be derived did not appear until two days later. Not much value, therefore, can be attached to this instance. The evidence is rather stronger in the instance contained in Report xl : two children from an infected house returned to school ; they had not suffered from the disease, but a boy at the school to whom they gave an apple was attacked six days after these two children had returned to school. In another instance it was thought probable that the infection of a woman who sold milk was brought about by her having had frequent dealings with the parents of a child who was suffering from fatal diphtheria. Another example of infection conveyed by a person who had resided in an infected house without, so far as appears, coming into very intimate contact with the sufferers is afforded by a youth (Report x) who came from an infected house to sleep every night in another house. This youth did not suffer, but the first person attacked in the house to which he went to sleep was the master, who was the only person to come in contact with the lad. Dr. Airy (Report v) mentions the case of a young servant, employed in a house in which a woman was suffering from diphtheria in an early stage, who appeared to have been the means of starting an epidemic in two isolated cottages, though not attacked herself. Report xii contains a case in which a woman residing in a village visited an infected house in a neighbouring town ; though she was not herself infected, the first case in the village was her child. The facts connected with another case (Report xxxvii) seemed to make it probable that infection was conveyed to a house by a lady who visited certain infected cottages, but did not herself suffer from the disease until a much later date, and after she had passed through a period of great anxiety, during which she was engaged in nursing members of her family. The same report mentions an instance in which it was thought that a woman who had helped to "lay out" a child dead of diphtheria conveyed the infection to her own children, although she did not suffer herself.

As to the mode of infection in such cases as those above enumerated, it is, of course, highly probable that in the majority the infection has been conveyed in clothes, but in some instances the interval has been long enough to warrant

the suggestion that the person who conveyed the infection may have suffered from diphtheria of so mild a type that it did not cause the sufferer to consider himself or herself ill.

Infection by personal intercourse.

In the great majority of the cases reported to the committee infection was to be traced to personal contact, direct or indirect, and the history of nearly all village and school epidemics points strongly in the same direction. Upon this head it will not be out of place to quote some observations made by Dr. Parsons on the influence of the parish boundaries on the mode of spread of diphtheria.

"It is to be observed," he writes, "that a parish is an area marked out in most cases by purely artificial or arbitrarily selected boundaries, and not conforming to any natural limits of physical or geological configuration; but, on the other hand, that the inhabitants of a rural parish have commonly more opportunities of intercommunication with each other—*e. g.* at the parish schools, at places of worship, at work, at the village shop, the public-house, &c.—than they have with the inhabitants of even closely adjoining parishes. In other words, a parish is commonly a social, not a physical division. If, then, we find a disease limited in its prevalence to the inhabitants of a particular rural parish, where there is no community of sewerage, or water or milk supply, the inference is that it is propagated by personal intercommunication rather than by natural physical agencies; and my inquiries have led me to the conclusion that this is the way in which diphtheria has been propagated in Eversholt. The village of Eversholt, if such it can be called, consists of no fewer than fourteen more or less distinct hamlets or Ends; some of these consist of but two or three houses, and at only two of them, Church End and Lower Rad's End, is there anything approaching a close aggregation of houses on the ground. The cottages are of a good class. . . . The limitation of the disease to the parish of Eversholt enables us to exclude atmospheric or telluric conditions, for on each side of Eversholt are other villages, little more distant from it than some parts of Eversholt are from one another, standing on the same soil (except Milton Bryant to the south, which is on the gault clay), and having doubtless the same or very nearly the same climate; yet these other villages have escaped the disease so far as is known, certainly

from any extensive or fatal prevalence. I have met with other instances of a limitation of the disease to a single parish, adjoining parishes similar in their physical circumstances having escaped, at the time at least."

Other sources of infection.

While the agency of personal intercourse as the main agent in the spread of an epidemic can hardly be disputed, it must be admitted that in a very considerable proportion of epidemics it is impossible to trace its operation in the earliest case. Dr. Airy has observed (*Report to the L. G. B. on Several Outbreaks of Diphtheria in the Fourth Quarter of* 1879) that diphtheria "will break out at a lonely farmhouse in a bleak waste, where intercourse is rare at all times, and, as regards infection, utterly untraceable. In the subsequent extension of diphtheria the agency of personal intercourse can generally be traced. This brings out more strongly the independent character of the commencement of the outbreak."

The inquiry made by the committee was not specially directed to this point, but attention may be called to the cases collected by it in which modes of infection other than personal intercourse appear to have been operative.

Cesspits and foul drains.—In a few cases infection is attributed to the emanations from the emptying of cesspits or foul drains. Examples are Cases 1, 2, 36, and 75, and the occurrence described in Report lx. The period of incubation in these cases varied considerably. In Case 75 (Report li) it was only a few hours. In Case 2 it was less than forty-eight hours. In Case 1 it was less than four days. In Case 36 (Report xvii) it was not more than eight nor less than five days.

Accepting the theory that the emanations were the causes of the subsequent diphtheria in these cases, two explanations of the source of the specific infection are tenable: it may have originated *de novo,* or the infective material may have entered the drain or cesspit at some long antecedent date, and have been preserved in the foul material therein contained. An instance in which this last event is believed to have occurred will be found in Report lx.

Domestic animals.—In a few instances infection is believed to have been conveyed by domestic animals. The cases do not afford any precise data as to the period of incubation, or of the duration of infection. In one instance (lix) the interval

between a visit to a farm at which the fowls were suffering from a disease thought to be diphtherial and the first case was said to have been about a week; in no instance is there any evidence pointing to an unusually short period of incubation.

Milk.—In three instances only among those reported to the committee was milk the medium of distributing the infection (Reports xiii, xxxix, xliv). In one only (xiii) do the facts give any information as to the length of the period of incubation, and in this instance no more can be said than that the circumstances are compatible with an incubation period of seven days or less, and are probably incompatible with a much longer period. An abstract of Mr. Power's report on the epidemic at York Town and Camberley is given mainly because it throws light on the persistence of the infective condition in milk, and even indicates that milk becomes more virulent when kept for twelve hours or more (Report xxxix). Dr. Bruce Lowe's observations (Report xliv) are of interest in this place, as they afford a striking contrast to the general behaviour of diphtheria: he remarks the "complete indifference to locality" in an epidemic traced to milk, which, he adds, is in "accord with previous experience of milk diphtheria;" whereas, as has been pointed out above, epidemics of diphtheria are, under other conditions, very largely limited or extended by circumstances of locality.

Conclusions.

Incubation period.—The incubation period of diphtheria does not as a rule exceed four days, and is more often two days than any other period. Not infrequently it extends to five, six, or seven days, but it is doubtful whether it ever exceeds the last-named period.

Infective period.—A person may be infected by a patient suffering from diphtheria (*a*) in the incubative stage; (*b*) during the developed attack; (*c*) for a period of long but uncertain and probably varying duration after apparent recovery. In such cases of late infection some unhealthy condition of throat will, as a rule at least, be found to have persisted, or possibly to have recurred.

Persistence of infection.—The infection of diphtheria can be retained in clothes, carpets, and other fomites for months, perhaps years.

Unrecognised diphtheria.—The infection of diphtheria may be derived from cases so mild that the patient never comes under medical treatment, or presents symptoms so little characteristic that their true nature is not recognised even after medical examination.

CASES.

Cases 1 *and* 2.

Communicated by Dr. James Weaver, Longton, Staffordshire.

Infection probably from foul drain.—A. C. (*Case* 1), about 12.30 p.m. on Good Friday, cleaned out an offensive drain in the yard of his house. It carried slop water, and had become stopped up. He also at the same time emptied an offensive rain-water barrel. His daughter, B. C. (*Case* 2), aged 10, stood beside him, watching his operations. B. C. was restless and feverish on the night between Saturday and Sunday, and early on Sunday morning complained of sore throat. Dr. W. saw her about 10 a.m. on Sunday. She was then ill and anxious; there was a small piece of membrane on one tonsil, and the whole throat was dark. On the next day she was better; the membrane had not extended, and from that date she made a good recovery. A. C. had well-marked symptoms of diphtheria on Tuesday morning. He made a good recovery.

Case 3.

Communicated by Dr. R. Bruce Low, Helmsley.

Very long interval.—Two brothers, E. and Y., left Dublin, where diphtheria was prevalent at the time, and arrived at a monastic school kept by Benedictines on August 27, 1875. There were 100 pupils and between 20 and 30 priests; the monastery is in a remote neighbourhood; no cases of diphtheria or enteric fever had ever been known to occur in it; the hygienic arrangements were "of the best description;" discipline was very perfect; there was very little, if any, contact with the outer world; there was no diphtheria in the district round the monastery, and Y. (*Case* 3) was not near any village or town during the time which elapsed between his arrival at the monastery and his attack. Special inquiry was made as to the receipt of any parcel, and it was ascertained that no parcel or packet was sent from Dublin to this or any other boy between August 27 and October 12, 1875. There may have been letters. Y., who was aged 12, was attacked by diphtheria on September 29, 1875 (thirty-three days after arriving at the monastery), and died on October 12. His elder brother, E., had no symptoms of illness either before or after these dates. Y. was isolated as soon as the disease was recognised, and no other cases occurred in the school.

Case 4.

Communicated by Dr. Alfred Clarke, Brigade Surgeon.

A man (*Case* 4) who had been isolated at another house went home on September 26 to his child, who died September 27. He remained at home and sickened, October 8, with diphtheria.

Four cases of diphtheria occurred in the family of Corporal F., one on November 5, 1888, followed by three others on November 6 and 8. One death occurred on November 16. The others convalesced, and the house was whitewashed and disinfected on November 18. On December 11 the baby, eleven months old, was attacked, and died December 15. It is not stated that the baby was kept apart from the convalescent children—probably not.

Communicated by Sir GEORGE BUCHANAN, F.R.S., late Medical Officer to the Local Government Board.

i.

Mr. W. H. POWER's Report to the Local Government Board on Prevalence of Diphtheria and other Throat Illness at Radwinter, dated August 3, 1877.

"No doubt that to a very large extent diphtheria and its allied throat complaints have spread in Radwinter by infection from person to person. . . . Between the occurrence of the first case in each house and succeeding ones an interval, an 'incubation period,' of two to four days was commonly apparent."

ii. *Cases* 5 *to* 8.

Dr. BLAXALL's Report to the Local Government Board on the Sanitary Condition of Padstow, &c., p. 7, dated March 13, 1878.

Infection conveyed by a convalescent.—H. B. left the Board school on December 12, suffering from diphtheria. He returned to school on January 8. On January 15 another child (*Case* 5) at the school was attacked, and died January 24.

Infection conveyed by a convalescent.—Two children, attacked on or about February 7, returned to school March 5. Between March 9 and 12 four fresh cases occurred amongst the school children. Two of these fresh cases (*Cases* 6 and 7) resided in villages where there had been no previous cases of diphtheria. The incubation period in the four cases was not more than four days in the shortest and seven in the longest.

Infection conveyed by a convalescent.—E. W. left the Board school on June 11, suffering from diphtheria, and returned to school on July 2. On July 6 another child (*Case* 8) in the school was attacked. Incubation period not more than four days.

iii. *Case* 9.

Dr. BLAXALL's Report to the L. G. B. on an Epidemic of Diphtheria in the R. S. D. of Sculcoates, Yorks, dated January 5, 1878.

Infection during incubation, and late convalescence.—On May 3 a child came home from (day) school suffering from early symptoms of an attack of diphtheria, which was not recognised as such; first case in this family. She was kept at home. On May 14 her sister, S. S. (*Case* 9), who was a domestic servant at Welton Wold, five miles away, returned home, remained there May 15, and went back to Welton Wold May 16. On May 18 she complained of sore throat, and on May 19 was seen by a medical man, who diagnosed diphtheria; she was sent home on May 20. Shortly afterwards her mistress and an infant were attacked by diphtheria, and died. S. S. was the first case at Welton Wold. Incubation in S. S. not more than four days nor less than two.

Speaking of the epidemic in general terms, Dr. Ballard says, "It is noteworthy that the infection would appear to have been disseminated by sufferers when in the incubative and acute stages of the disease, and also after a long period of convalescence."

iv. *Case* 10.

Dr. W. Ogle's Report to the L. G. B. on Diphtheria in the R. S. D. of Barnstaple, dated June 12, 1879.

A girl, aged 3, attended, down to October 28 inclusive, a school at which a number of children had recently contracted diphtheria. Her mother was "most positive that the illness"—diphtheria, from which she died on November 15—"dated from November 8"—eleven days after last attendance at school. Between October 28 and November 8 the child had been carefully kept from all intercourse with cottages already infected.

v. *Cases* 11 *to* 13.

Dr. Airy's Report to the L. G. B. on Several Outbreaks of Diphtheria in the Fourth Quarter of 1879, dated December 11, 1880.

Infection from patient in stage of incubation.—A private school, with nine scholars, in a village, reopened after harvest holidays on September 8. One child, J. S., who had been staying at Forest Gate, near London, did not return till next day, September 9. On September 12 J. S. was ill, and did not go to school. On September 15 she was seen by a medical man, who found her to have diphtheria. On September 13 another girl at this school, M. W. (*Case* 11), was taken ill. She was seen by a medical man on September 15, who found her suffering from diphtheria. A third case in the school, H. T. (*Case* 12), occurred on September 18. The only other child in the school who contracted the disease was a sister of H. T., who may have caught, and "in all probability" did catch the disease in her own home. J. S., M. W., and H. T. were the three occupants of one side of the same table at school. It will be noted that M. W. developed the disease one day after J. S., but that she had sat close to her at school on Septemper 9, 10, and 11; and if, as Dr. Airy concludes to be most probable, M. W. caught diphtheria from J. S., it must have been while the latter was in the incubative stage. M. W. had, during the holidays, been staying at a village about a mile from another village in which cases of diphtheria had occurred fifteen to eighteen months earlier, but there was "no evidence that she had been in contact with any person or thing that could be suspected of harbouring the infection of diphtheria." Four cases in the family of H. T. were the only other cases in the village of Felstead. (In M. W. the period of incubation could not have exceeded four days; H. T. sickened five days after the last day on which M. W. was at school.)

Fatal "sore throat."—A servant girl in a carpenter's home in a small village had a sore throat on November 24, and returned to her own home, a quarryman's cottage in a distant village, on November 25. Diphtheria had first appeared in the carpenter's family on November 17. The servant remained at home until December 1. Her brother (*Case* 13), aged 10½, was taken ill on December 4 (nine days after his sister had come home and three days after she left), and died on December 11 of ulcerated sore throat. No other cases.

Customary modes of spread; unrecognised cases; (?) fomites.—Dr. Airy observed that, as a rule, if diphtheria was introduced into a family it was found that all or most of the children were attacked, some perhaps simultaneously, or at intervals of one or two days or a week, the parents at the same time often suffering from more or less severe

sore throat. As to spreading by personal communication: (1) The most frequently operative circumstance was residence under the same roof. (2) The next most frequently operative was sitting together in the same school. (3) Probably often disseminated at church and chapel. (4) May be caught by occasional visits to the bedroom, dwelling, or shop of a diphtheria patient. (5) A person who, having been exposed to diphtheria, suffers from sore throat not recognised as diphtheria, may yet start an epidemic in another and distant locality. (6) *Diphtheria may be conveyed to a new locality by a person who has been in contact with a diphtheria patient, but has not himself contracted the disease.* Of this Dr. Airy gives the following example:—A girl, W., aged 13, in service at a house infected with diphtheria (woman in early stage) went to her home, one of an isolated pair of cottages, high among mountains six miles away, on November 11. She remained at home until November 15. She herself had no sore throat, at least she was not ill, but shortly after her return to service two of her sisters who resided at home were taken ill with sore throat. They recovered, but early in December the infection appeared in the family residing in the adjoining cottage, and caused one death. Dr. Airy suggests that infection may have been conveyed in the clothes of the girl W., or about her person.

vi. *Cases* 14 *to* 18.

Mr. W. H. Power's Report to the L. G. B. on Diphtheria at the Hospital for Sick Children, Great Ormond Street, dated November 15, 1880.

The following cases are mentioned by Mr. Power as showing the periods intervening between the presumed opportunity for contracting diphtheria and actual manifestation of the disease in particular cases.

K. (*Case* 14), aged $5\frac{2}{12}$, admitted for rheumatism six days before being attacked with diphtheria. Not more than six days. Wa. (*Case* 15), aged $2\frac{5}{12}$, admitted for pneumonia thirteen days before being attacked by diphtheria. Not more than thirteen days. Wi. (*Case* 16), aged $4\frac{5}{12}$, admitted for typhoid fever fourteen days before being attacked by diphtheria. Not more than fourteen days. C. (*Case* 17), aged $3\frac{1}{12}$, was under treatment for eighteen days for wryneck during the prevalence of the epidemic, and was discharged on March 14. This child was attacked on March 23, was readmitted, and died in hospital. Not less than nine days. R. (*Case* 18), aged $3\frac{3}{12}$, was in the hospital for thirteen days before March 13, on which day he was discharged. Was attacked "not less than fourteen days" after leaving hospital, and died at home (exact dates not given). The disease was probably contracted in all these cases from some common cause operating within the hospital, and affecting all patients.

vii. *Case* 19.

Dr. Parsons' Report to the L. G. B. on Diphtheria at Gedney Grove End, &c., dated December 26, 1882.

L. (*Case* 19), a governess at an outlying farmhouse, was taken ill on October 17 with sore throat, which turned out to be diphtheria. She was at church on October 15, and sat "just on the other side of the aisle" to a Mrs. H., whose son had died of diphtheria on October 7. In the next cottage to Mrs. H., and under the same roof, lived a boy who began with diphtheria on October 9. Mrs. H. had probably conveyed the infection in the first place to her son, as she had had sore

throat before the boy, and had previously to that visited another cottage in which an earlier case of diphtheria had occurred. Mrs. H. was not attended by a medical man. If the hypothesis is accepted, then infection was conveyed by a convalescent from an unrecognised attack, and the incubation period was two days.

viii. *Case* 20.

Dr. AIRY's Report to the L. G. B. on an Outbreak of Diphtheria at King's Lynn, dated July 24, 1882.

During an endemic prevalence of diphtheria in King's Lynn a servant girl (*Case* 20), in a house next door to one in which a case of diphtheria occurred on October 10, was on October 17 sent to the village of Gayton, seven miles from Lynn. She sickened with diphtheria on October 22 (five days after cessation of exposure). Only one other case of "sore throat" occurred at Gayton, the patient being a lad who had been lodging at Lynn and returned to Gayton ill on October 7.

ix. *Case* 21.

Dr. PARSONS' Report to the L. G. B. on an Outbreak of Diphtheria in the Sutton-in-Ashfield U. S. D., dated June 26, 1882.

A girl (*Case* 21) living in service in another part of Sutton came home one Sunday afternoon to visit her friends. She saw and kissed a little girl living next door who was ill with an "ulcerated sore throat," which was pronounced by the doctor next day to be diphtheria, and proved fatal. The servant girl returned to her place, and on the Thursday (*four days after kissing the little girl*) she was taken ill with diphtheria, which was followed by pharyngeal paralysis.

x. *Case* 22.

Dr. H. F. PARSONS' Report to the L. G. B. on the Prevalence of Diphtheria during 1881–2 at Tempsford (unpublished), dated December 30, 1882.

Conveyance of infection by a person not herself attacked.—Infection was apparently brought to the village by a woman who had visited a house where diphtheria existed in Bedford. The woman herself escaped, but her child whom she had not taken with her was the first to suffer.

Infection by convalescent patient.—Two children, members of one family, attending school, were taken ill on November 2 and 16 respectively, and were removed to hospital November 16 and 18. After their discharge from hospital they went back to school on December 11. On December 13 a girl (*Case* 22) who acted as monitor of the class which these two children had rejoined was taken ill with diphtheria.

xi.

Dr. BLAXALL'S Report to the L. G. B. on Epidemics of Diphtheria in the Taunton R. S. D., dated September 6, 1883.

Infection by a convalescent patient.—In the family of Mr. R., residing at a water-mill, four sons were attacked with diphtheria in September 1881; at this time the disease was probably imported by two of the sons who were first attacked and went to a school in the neighbourhood of which diphtheria then existed. The next case occurred in September, 1882, the patient being the governess, who was in the habit of visiting

Taunton, which was then infected; she was removed to the hospital at Taunton, and subsequently went to Minehead where the R.'s also were staying, but in different lodgings. "At the end of a week or so she returned with the family" to the mill house, "and shortly afterwards" cases of diphtheria occurred in the house.

xii. *Cases* 23 *to* 25.

Dr. BLAXALL'S Report upon the long-continued Prevalence of Diphtheria in the U. S. D. of Taunton, dated September 6, 1883.

The inquiry was directed in consequence of a considerable epidemic which occurred in 1881–2.

Single short interview with patient in incubative stage.—P. (*Case* 23), a child, was taken by her mother to a Kindergarten school, and while waiting outside was kissed by X., one of the pupils, who ran out of the school. It does not appear that P. entered the school. On the following day a medical man was called to X., and found her suffering from diphtheria. Two days later (three to four days after the interview between P. and X.) the same medical man was called to P., and found her also suffering from diphtheria.

A girl, B., in service in a family several members of which were suffering from sore throat of an indefinite character, was sent back to the Servants' Home suffering from sore throat. Two days after B.'s return to the Home she manifested symptoms of diphtheria, and was sent to the hospital. Two days later C. (*Case* 24), another inmate of the Home, who had been in contact with B., also manifested diphtheria. There had been no cases of diphtheria in the Home before B. The incubation period in C. may have been four, but cannot have been less than two days.

Infection apparently conveyed by a person who did not suffer.—A little girl in the family of Mr. H. was taken ill with diphtheria on November 17, and died November 22. The four other children were sent away to their grandmother's in another part of the town on November 21. A second daughter, E., was here attacked on November 22. The remaining three children were kept apart from E., but remained in the grandmother's house until November 25, on which date the mother also sickened. On this day (November 25) these three children were removed to a house a few doors off; nine days later the grandmother who had been nursing Mrs. H. and E. called at this house to see the children who had remained healthy. The grandmother, who entirely escaped the disease, and had no sore throat, kissed one of the children, a girl, L. (*Case* 25), aged 8, but not the others. Two days afterwards L. was attacked.

Infection by a convalescent patient.—One of a family of six children was attacked with diphtheria and sent to hospital; on being discharged from there he was taken to Minehead for a week or two, and then returned to his own home. His voice and vision were much affected, and there was a free and offensive discharge from his nose. Shortly afterwards a second child and a servant were attacked.

Conveyance of infection by a person not himself attacked.—A youth went to the house of Mr. Hy. every night to sleep. "The youth was not himself attacked, but he came direct from a house in which four or five cases of diphtheria were present." Mr. Hy. was the only person who came in contact with this lad, and he contracted the disease, the infection subsequently spreading to his two sons and the servant.

xiii.

Mr. W. H. Power's Report to the L. G. B. on an Outbreak of Diphtheria in the Hendon U. S. D., dated April 5, 1883.

Milk.—There was a special incidence of diphtheria and throat illness among the customers of a particular dairy, and especially on large consumers of the milk in an uncooked state. The evidence to connect this milk with the diphtheria, though it fell short of absolute demonstration, was very strong. There was abundant evidence that shortly before the outbreak "the milk distributed from this particular dairy was ropy or stringy. Especially was this the case on the 1st and 2nd of January." The following cases constituted the beginning of the outbreak:

Household.	Age.	Date of attack and nature of illness.	Interval after Jan. 1.
C. L.	Nurse	Jan. 2.—Diphtheria	1 day.
,,	8	,, 5. ,,	4 days
,,	3½	,, ,,	,,
,,	1¼	,, ,,	,,
S. G.	Cook	,, ,,	,,
T. P. A.	Servant	,, ,,	,,
	13	,, ,,	,,
	10	Jan. 6. ,,	5 days.
	11	,, ,,	,,
T. P. B.	9	Jan. 5.—Diphtheritic sore throat	4 days.
	13	,, ,,	,,
H. H. A.	3 children	,, 5 and 6.—Sore throats	4, 4 or 5, and 5.
T. P. C.	6	,, 5.—Diphtheria	4 days.
,,	3	,, 6. ,,	5 ,,
H. H. B.	4 adults	,, 5 and 6.—Sore throats.	4, 4 or 5, 4 or 5, 5
T. P. D.	8	,, 5.—Diphtheritic sore throat	4 days.
,,	6	,, ,,	,,
,,	4	,, ,,	,,
,,	3	Jan. 8.—Fatal diphtheria	7 ,,
T. P. E.	2 children	Jan. 5 and 6.—Diphtheritic sore throat	4 and 5.

xiv.

Dr. Downes' Report to the L. G. B. on an Outbreak of Diphtheria at Oaksey, in the Malmesbury R. S. D., dated June 15, 1883.

Infection by convalescent patient with paralytic symptoms; suggested increase in infectivity at a late stage—A child, C. T., aged 10, then residing with her mother at Cirencester, ceased attendance at school on May 2 on account of sore throat of a mild character not recognised as diphtheria, and on May 22 was sent to her grandmother at the village of Oaksey to recruit. "On her arrival, or soon after, it was noticed by several persons that her voice was peculiar, 'just like some of the children who had diphtheria.' Moreover her sight was defective, and she had difficulty in swallowing, so that 'bits of food stopped in her throat.' On June 10, nineteen days after C.'s arrival, there sickened with diphtheria E. S., aged 3, living with the same grandparents, and W. S., aged 5, living at their sons, next door. Neither had attended

any school, nor had been exposed to any known source of infection other than C. T." Dr. Downes does *not* think that the evidence "*justifies an hypothesis of nineteen days' incubation.* It indicates rather that the quality of infectiousness did not attach itself to her throat illness until some time after her arrival at Oaksey, or that till then its intensity, or at least its potentiality of diffusion, was small." He advanced the suggestion "that in diphtheria there may be a period in the later stages or in convalescence when the *contagium* becomes more readily transferable. For example, there is reason to connect the November explosion with" a patient "who was attacked October 11 and returned to school on October 30. But no case followed until November 14, although no other source of contagion could, by the strictest inquiry, be discovered. And it is still more curious that the main part of this explosion yet later in the month was in its incidence remarkably associated with the movements of this child. That an explosion of diphtheria should centre round a single case is quite in accord with my experience elsewhere." The case which occurred on November 14 was a child who was a great friend of the child attacked on October 14, and attended the same school.

xv. *Cases* 26 *to* 29.

Dr. Blaxall's Report to the L. G. B. upon the Sanitary Condition of Calne in connection with an Outbreak of Diphtheria and Typhoid Fever in that town, dated June 17, 1884.

Infection by a convalescent patient.—The epidemic (May to December, 1883) was due to introduction from without, and disseminated by the promiscuous intermixing of infected and healthy, some of the schools playing a prominent part in the dissemination. A boy, A., aged 11, who resided in a village about a mile from Calne, was attacked with severe sore throat on May 4. He probably contracted the disease from a family of infected relations living in another village. A. had attended T. school in Calne up to the date of his illness. He was absent from school five weeks, and during this period no further case occurred in the school. A. again began to attend school on June 5. On June 11 (*six days after A.'s return*) a girl, W. R. (*Case* 26), in the same class with A., was attacked. Other cases followed.

"*Simple sore throat*" *followed by cases of diphtheria.*—Meanwhile the disease had been introduced into the town by another person, a servant girl, B., who returned to Calne, after an absence of about three weeks, on or about May 11. She had been away with her mistress's children, one of whom had suffered from what was regarded by the medical practitioner called in as a sore throat of a very slight character. B. first saw a medical man on May 14, and her illness was recognised as diphtheria on May 15. On that day she was sent home. W., a baker's man, apparently contracted the disease from her, and W.'s children from him. One of these children, John W., attended the B. I. school up to June 6, when he went home ill (he died June 14). The next case in the school was H. (*Case* 27), who went home ill on June 9 (three days after John W.). No fresh case occurred in the school until June 18, when H.'s sister and three other pupils sickened: H. returned to school on June 18. If the three other children were infected by H.'s sister, this must have been either derived from her while in the incubative stage or carried in her clothes.

E. M., who had diphtheria during the holidays, began to attend the

G. school at its reopening on August 27; she was then in the convalescent stage. Two other children, friends of hers, attending the same school, sickened on September 4 and September 10 respectively, eight days after reopening of school in the first case (*Case* 28), and in the second case six days after the first case.

During the girl B.'s illness her brother (*Case* 29) came down from London for the day, and three or four days after his return to town he was attacked with diphtheria.

xvi. *Cases* 30 *and* 31.

Dr. Parsons' Report to the L. G. B. on Outbreaks of Diphtheria at Hambledon and other places in the Droxford R. S. D., March 24, 1884.

Hambledon is a large but isolated village on the Hampshire Chalk Downs. Diphtheria was probably imported from Portsmouth, the nearest town. The earliest cases were obscurely referred to antecedent cases of scarlatina, and were not recognised as diphtheria. In the two following cases the duration of incubation could be fixed.

Case 30.—Mrs. —— went in early one Saturday morning to see a neighbour's child who was dying of diphtheria; this was the only occasion. She was much frightened. On Monday afternoon she was taken ill herself with diphtheria. In this case the incubation period was fifty-seven hours.

A boy of six who died of diphtheria had played in a cart-shed with another boy convalescent from the disease, who had given him a bite of an apple.

Case 31.—A boy of five, residing in an outlying part of the parish where there were no other cases, met one Monday in the harvest-field an older boy just recovered from a slight attack of diphtheria three weeks previously, who gave him a ride "on pickaback." On the following Saturday the little boy was taken ill of diphtheria, the incubation period being thus in this case five days.

Infection conveyed by person who did not suffer, and by clothes.—At the neighbouring village of Shedfield a severe circumscribed outbreak was originated in 1882 by a carpenter's apprentice who spent a few days at Portsmouth, and on his return to work was laid up for ten days with sore throat, followed by difficulty of swallowing which lasted some time. The carpenter's children suffered severely (five deaths in six cases). The father also had it, with subsequent paralysis of arms. Mrs. F. (senior), an elderly woman who lived in a neighbouring house, went to the carpenter's a few times to nurse the children. About a fortnight afterwards her daughter, aged 13, who is said not to have been to the carpenter's herself, was taken ill of diphtheria, and died on June 21, after three weeks' illness, her mother (who had had diphtheria twenty-five years before) not being affected. After the girl's death the house was thoroughly fumigated, the paper stripped off, and the walls lime-washed; and, as it was thought, all infected clothing was washed or fumigated. It was hoped that the disease was at an end, but five weeks later it broke out in the household of Mrs. F.'s son, living in a neighbouring cottage. For a long time this recurrence of the disease was difficult to account for, but it was ascertained that some of the clothing infected by Mrs. F.'s daughter was put away unwashed, and that another daughter, who came home a month later to live at her brother's, turned it out and washed it; she caught diphtheria and died.

In the house of Mr. F. junior there were four cases of diphtheria, of which three died on the same day.

xvii. *Cases* 32 *to* 36.

Dr. Parsons' Report to the L. G. B. on the recent Prevalence of Diphtheria at Eversholt, in the Woburn R. S. D., May 12, 1884.

Infection by convalescent unrecognised case.—A girl, aged 11, was away from school on account of illness from the end of June to the end of July. She was considered by the medical officer of health to have had diphtheria affecting the nasal passages, from the after effects of which she had not completely recovered when she was seen by him on August 24. On July 23 a school treat was held, at which this girl B. was present. The day was wet, and the children, about 100 in number, took refuge in a cow-shed. Among those at this treat were two children of the village shopkeeper at Church End, one of whom (*Case* 32) was taken ill on or about July 25, the other on or about July 31; both cases were fatal. These were the first recognised cases of diphtheria, but other cases of the same nature occurred about the same time among other children who had attended the treat, and Dr. Parsons considers it "likely" that the infection was acquired there.

Scarlet fever and diphtheria in members of same family.—It is probable that the infection was introduced into Eversholt by a boy, Albert, who lived at Roehampton, Surrey. Three other children of Albert's family had suffered at Roehampton from diphtheria in April and May, and Albert himself had had scarlet fever at the same time, but had been kept altogether apart from the others until all were considered to have recovered. There had been other previous cases of diphtheria and scarlet fever at Roehampton, some of them in the families of persons living and working in the same estate as the father of these children. On June 2 the rooms in which the diphtheria patients had been were fumigated with chlorine, and the bedding was stoved in the disinfecting oven of the Wandsworth Board of Works. For a day or two before his leaving home Albert had associated with his brothers and sisters who had had diphtheria. On June 8 he was examined by the family doctor, who considered that he might safely be removed. However, on or shortly after his arrival at Eversholt, he was found to be suffering from sore throat, which grew worse, and on June 12 he was sent away to another relative at Hinton, near Brackley, Northamptonshire, where he died on June 21, the certified cause of death being diphtheria. A little girl living in the same house at Hinton also took diphtheria a few days after Albert's arrival.

Another outbreak occurred among Eversholt school-children in November. The first case (origin uncertain) in this outbreak was—

Infection communicated by patient in early stage.—A. G., aged 4, living at Tyrrell's End, had had for a few days what were thought to be symptoms of an ordinary cold. On the morning of November 23 he vomited, but nevertheless went to school that day, though not afterwards. On November 28 his mother, observing white patches on his throat, sent for a doctor, who pronounced his illness to be diphtheria. He had a severe attack, but ultimately recovered. Three of A. G.'s class-fellows (*Cases* 33, 34, 35), belonging to different families and residing at different Ends, were taken ill of diphtheria, two on November 26 and one on November 28; incubation period three to five days. "The inference

seems allowable that they may have taken the disease from A. G. on the 23rd."

Infection from (?) contents of cesspit; infection communicated by patient in early stage.—A third outbreak occurred in February. It was traced with great probability to F. F. (*Case* 36), aged 8, living at Church End within a few doors of the school, who complained of sore throat on February 12, but had been ailing a few days before with what were thought to be symptoms of a common cold. Although so ill that his mother had to sit up with him part of one or two nights, he went to school by day up to and on the morning of February 13, on which day, the nature of his illness being recognised, he was kept at home. Of the five subsequent cases among school-children, four were in the same class as this boy—a different class, and held in a different room, from that in which the November cases occurred. As to the origin of F. F.'s case, he may, it is suggested, have caught the disease by playing with another boy who had sore throat about five weeks earlier. A privy cesspit was emptied at F. F.'s home on February 4, and the contents left in the yard slightly covered with ashes until February 7.

Persistence of infection in a house.—"The persistence with which the contagion of diphtheria is apt," Dr. Parsons writes, "to attach itself to places is well known; the following is an instance in point. In a house at Church End several members of a family had been attacked with diphtheria in December, but in the course of January all had either recovered or died. The house was subsequently fumigated with burning sulphur, the wall-paper stripped off, and the walls lime-washed. The floors, which were old and irregular, were washed with carbolic soap. Infected articles of clothing were either burnt, washed, or fumigated. On February 8 a daughter came home from service with a bad finger, and on February 13 she was taken ill with diphtheria. She had slept in a room which had been used by the sick, but which had been purified as above described. She had noticed, however, a bad smell in the neighbourhood of the fireplace where certain articles soiled by the sick had been burnt. Also a piece of list nailed around the door-frame to exclude draught had been allowed to remain; this list, which, from its position, would intercept particles floating in the air entering or leaving the room by the chink of the door, was found full of dust."

xviii. *Cases* 37 *to* 39.

Dr. Blaxall's Report to the L. G. B. on the Prevalence of Diphtheria in the R. S. D. of Kingsclere, Hants, May 15, 1884.

Diphtheria preceded by simple sore throat and so-called mumps.—Diphtheria probably spread by school attendance; small villages; agricultural population. Dr. Blaxall assumes "the incubating period of diphtheria" to be "from two to four or five days."

The chief outbreak was at Ashford Hill. There was a very extensive prevalence of measles in a mild form in the June quarter, and mumps were also very general, often occurring side by side with measles. Certain of these cases of "mumps"* were followed by paralysis, and Dr. B. considers that mumps and diphtheria were present in the school at the same time. Scarlet fever had prevailed in 1882, and

* Several other instances of this confusion between mumps and diphtheria may be found in reports made to the Local Government Board by its inspectors.

Dr. B. found undoubted evidence of recent attacks. The outbreak occurred July 1—5. "Throat affections in one form or another appear to have been generally prevalent in the infected localities, not unfrequently accompanying measles, sometimes simple sore throat, with little or no constitutional disturbance and of short duration; other cases of a specific character passing in sequence through families, accompanied by fever, headache, and general malaise, leaving the sufferers much debilitated, and occasionally with voice and vision affected."

Not infective four days before attack.—At Headley Common, another village, only three cases occurred, but there had been other previous cases of sore throat and "mumps." S. S. (*Case* 37), the sister of one of these patients with sore throat, was taken ill on July 2 or 3, and was first seen by a medical man on July 5, who pronounced the disease to be diphtheria. S. S. had ceased to attend school as early as June 28, but subsequently her two little nieces (*Cases* 38, 39), who lived about three quarters of a mile off, and came to see her one Sunday in July, were taken with diphtheria two days after their visit. "If we may believe that they were infected from their aunt, the escape of all S.'s schoolfellows, eighty-six in number, has to be explained by her diphtheria not having reached an infective stage on the last day of her attendance at the school."

xix. *Cases* 40 *and* 41.

Dr. Blaxall's Report to the L. G. B. on Diphtheria in the Eastern Division of the Chippenham R. S. D., dated August 23, 1884.

Infection by unrecognised cases.—A little girl, J. Ck. (*Case* 40), was taken by her mother to stay at Mr. C.'s house on October 20, 1884. Two of C.'s children were at about this time suffering from unrecognised diphtheria. J. Ck. returned home on October 23, was taken ill with diphtheria on that evening (three days after commencement of infection), and died on October 28. So far as could be ascertained by inquiry of J. Ck.'s mother and of the local medical practitioner, no sore throat or diphtheria had recently been existent in the family or neighbours of J. Ck.

Infection apparently conveyed by individual who did not suffer.—Mr. and Mrs. B. and family exchanged visits with C.'s family, and three of B.'s children suffered, one dying. One day, shortly after the first child was attacked, Mrs. B. drove five miles to see a Mrs. F., whose little boy, a year old (*Case* 41), she took in her arms and nursed for a little while. Two or three days afterwards this child was taken ill with diphtheria, and subsequently Mrs. F. was attacked. Mrs. B. had not suffered from diphtheria, but she had been in close attendance on her sick child, and this casual visit of Mrs. B.'s was apparently the only opportunity of infection to which the F. family had been exposed.

Infection conveyed by a convalescent patient.—One of C.'s daughters, while convalescing from unrecognised diphtheria, went away to stay with her grandfather; her voice was then affected, and the glands of her neck swollen. Shortly after her arrival Miss F., with whom she slept, was attacked with typical diphtheria, and three cases of sore throat of an indefinite character followed in other members of the household.*

* As an illustration of the complexity of questions which may arise in

xx. *Cases* 42 *to* 44.

Mr. JOHN SPEAR's Report to the L. G. B. upon a re-inspection of the Registration Sub-district of Dartford, and upon the continued prevalence in the district of Diphtheria, dated July 15, 1884.

Diphtheria and "sore throat."—In March, 1883, there was a small outbreak of diphtheria in the parish of Stone. Three children, living at houses widely separated, were attacked on March 25 with well-marked diphtheria, and on the same day four others sickened of ailments of which sore throat and feverishness were the prominent symptoms. These children all went to the same school, and on March 21—four days before their seizure—a fellow-pupil had discontinued attendance owing to severe sore throat. All the affected children, including the last named, were accustomed to take their midday meal at the school, usually in the school lobby, their homes being at a distance. Here seven children were equally exposed to infection by a child suffering from the early symptoms of a "severe sore throat;" all seven were taken ill on the same day with a throat affection, but in three only was it distinctly diphtheria.

xxi. *Cases* 45 *and* 46.

Mr. JOHN SPEAR's Report to the L. G. B. upon recent Prevalence of Diphtheria in the Spilsby R. S. D., May 30, 1885.

Unrecognised diphtheria followed by diphtheria.—A servant at a farmhouse in the hamlet of Eau-Dyke complained of sore throat a few days before January 25, and died January 27, her death being registered as from "heart disease," though her throat was said to have been much swollen. Three days later her mistress was taken ill with unequivocal diphtheria, and died after two days' illness. A Mrs. F. (*Case* 45) was at the farmhouse on January 27, 28, 29, and 30, and was with the servant at her death. Mrs. F. was ill on January 30, and she died of diphtheria on February 4. Within the next ten days seven of her nine children had diphtheria, and six died.

Another woman (*Case* 46) nursed the farmer's wife for a few hours only on February 1. On the afternoon of February 4 (three days after her visit to the farmhouse) she felt poorly with headache and sore throat. She had nine children at home; seven of these were seized with diphtheria *two days* after their mother's seizure, and the remaining two a few days later: all except a baby had the disease severely, but none died. The infection may have been contracted by these children directly from their mother while she was in a very early stage, or indirectly from (?) clothes brought from the infected house.

xxii. *Cases* 47 *to* 49.

Dr. GRESSWELL's Report to the L. G. B. on the Prevalence of Diphtheria in the R. S. D. of Erpingham, December 7, 1885.

Short exposure; second attack in one individual.—Three children of

attempting to ascertain the origin of outbreaks of diphtheria, owing to the frequency with which the disease is unrecognised, it may be mentioned that several of these families occupied large dairy farms, supplying milk and cream to various companies, to whom the farmers were under heavy bond to report the presence of infectious disease; but in the present instances this course was impracticable, the nature of the disease not being recognised.

the same family met children of a still infected family on July 31. They fell ill as follows.—R., aged 9 (*Case* 47), morning, and M., aged 7 (*Case* 48), night of August 6 (six days after exposure); G., aged 6 (*Case* 49), morning of August 7. The attack was attributed to a "monstrous nuisance" arising from a large overflowing privy vault, and an elder sister, aged 18, who had had diphtheria seven years before, began with diphtheria on the evening of August 7, so that there is some doubt whether the infection ought to be traced to the short interview.

xxiii. *Case* 50.

Mr. R. D. SWEETING's Report to the L. G. B. on Diphtheria in the Farnham Reg. D.

Pirbright school was closed during part of the summer of 1882, as it was believed to be then playing a part in the dissemination of diphtheria; Mr. Power's investigation confirmed this view. A girl, aged 11, residing at an isolated park lodge at Ash, attended Pirbright school on June 27, 1882, the day it reopened. She was attacked with diphtheria on June 29 (two days).

xxiv. *Case* 51.

Dr. GRESSWELL's Report to the L. G. B. on the Prevalence of Diphtheria in the R. S. D. of Glanford Brigg, August 7, 1885.

Infection by children probably a month after attack.—A servant girl who contracted diphtheria while at her place was sent home while still ill at the end of July, or beginning of August, 1884. Shortly afterwards her brother, W. M., aged 7, took diphtheria; another brother, R. M., aged 11, and the mother also suffered from sore throat. R. M. and W. M., though still suffering from sore throat, began to attend school when it reopened on September 13, after the harvest holidays. They attended regularly up to October 3.

G. H., aged 5½ (*Case* 51), attended school up to September 19, was taken ill September 21, and died September 27. Other cases occurred among the children on September 28 and October 1, and two on October 2.

Infection conveyed by individuals who did not suffer.—Two other cases occurred in G. H.'s family, and during their illness the father and mother went frequently to buy milk of a Mrs. C., who fell ill in October; her husband and daughter were subsequently affected.

xxv. *Case* 52.

Dr. GRESSWELL's Report to the L. G. B. on Recurrence of Diphtheria at a farmhouse at Norton, 1885.

Infection long persisting in a house.—Prior to March, 1881, no case of sore throat, croup, or diphtheria was remembered to have occurred. The sanitary arrangements and surroundings of the house, which was occupied by the H. family, were bad. In March, M. A., nursemaid, was taken ill; she remained in the house forty-eight hours, was then sent to a cottage half a mile away, and died of diphtheria on March 16, 1881. K. H., aged 14 (*Case* 52), sat with M. A. for a few minutes on March 16, and on that occasion only; "she complained of symptoms of diphtheria on the 20th, allowing thus an incubation of about four days." K. H. was isolated; most of the other children were sent away, and when convalescent K. H. also went away. She returned in July, and shortly afterwards the cook, A. P., was taken ill; she was sent home, and com-

municated diphtheria to several persons, of whom two died. Seven weeks after the commencement of her illness A. P. returned, and "very soon afterwards, in September," C. D., who had replaced M. A. as nursemaid, fell ill; she was sent away, but returned in three weeks (1882). "A week or so after her return the governess took diphtheria," and later the father of the family. A few months later, the spring cleaning having just commenced, a housemaid, M. C., aged 18, who had been for some years in the house, fell ill. M. C. occupied the same bedroom as M. A., A. P., and C. D. M. C. was not sent away, and recovered in ten days. On one occasion the groom helped to move M. C.'s luggage, and a few days after his child, aged 5, was taken ill, and died of diphtheria. The groom and his family lived in a new clean cottage. Three children of the H. family, aged respectively 9, 3, and 2, subsequently fell ill in succession. The latest of these cases occurred in July, 1882. No fresh case occurred until soon after the commencement of the spring cleaning in 1883; then a servant maid, M. K., who had entered Mr. H.'s service *in* May, 1882, was taken ill. C. H., one of the H. family, had "a severe attack of tonsillitis" in July, 1883. The next case occurred in September, 1884, when, soon after the commencement of house-cleaning, M. T., who had been cook for two years, fell ill of diphtheria. Two weeks later, A. S., nursemaid, fell ill, and then, during October, A. H. and E. H. The next case occurred soon after the commencement of the spring cleaning of 1885, in the person of M. C., who had suffered in 1882; shortly after, another servant had sore throat. Dr. Gresswell, in discussing the means by which the infection was perpetuated in this house, states—(1) That he was unable to trace connecting cases during the intervals in the surrounding villages. (2) That M. C. suffered from several attacks of sore throat subsequently to her first attack of diphtheria. (3) That R. H., another son of the family, had "been always suffering for some years from sore throat," though he was not at any time recognised to have had diphtheria. (4) That a slop cesspool, which could not be emptied, but soaked away into the soil, and had "received washings, no doubt, from many of the diphtheritic patients," ventilated into a confined kitchen yard, and that its contents soaked into the wells. (5) On the other hand, that each outbreak commenced in one or other of the servants, shortly after the beginning of spring or autumn house-cleaning. Great trouble was taken in disinfecting the house, but the carpets, the contents of the mattresses, and some of the clothing had not been disinfected. The house consisted of two portions, new and old; the old portion stood on the bare earth, and one room in it, used as a breakfast and school room, had a brick floor a few inches below the surrounding level, and generally so damp that two thicknesses of carpet were in constant use; the lower had at times become rotten, and friable to the touch. Large quantities of white mould accumulated rapidly on the floor, and an offensive smell was frequently perceived in the room. The servants' bedroom was in the old part of the house; it was large, but having no fireplace, and only one window, its ventilation was deficient. Foot-halt and mouth disease had occurred on the farm. About 1883 and 1884 every cat taken to the farm died.

xxvi.

Dr. Simpson's Report to the L. G. B. on the Prevalence of Diphtheria in the Urban and R. S. D. of Shaftesbury, May 15, 1885.

Infection conveyed by patient supposed to have recovered; sore throats persistent in a house liable to floods.—The disease in this district was first prevalent in Melbury, a village two and a half miles from Shaftesbury. The primary cases in each family in Melbury were children, and all, with one exception, were attending school. The school opened on October 1, 1883, and in a fortnight's time eleven children were away on account of sore throat, which ended fatally in one and caused paralysis in three. There were eighty-one children at the school, but the sore throat occurred only among the children, fifty-two in number, belonging to Classes A and B. Of Class A, 12·9 per cent. were attacked; of Class B, 33·3. One of the children who resumed school attendance on October 1 was M., a girl who was still suffering from a sore throat which had compelled her to cease attendance before the holidays; this child belonged to Class B, and it was chiefly her playmates who were first affected. Moreover the only primary case which did not attend school was a little boy who, up to within four days of his death, had resided in the same house with M. This house was an old mill, much out of repair, situate at the bottom of a ravine beside a millpond, and liable to floods. No history of the introduction of the disease into this house could be ascertained, but it was elicited that sore throats had been prevalent in the house for two years at least. The house was liable to be flooded, the soil had become waterlogged, and the ground-floor was so damp that it could only be inhabited for a few months in the summer-time; the walls of this and of the upper floor were wet and covered with moulds, and the woodwork rotten. "On each occasion of the floods," Dr. Simpson observes, "the animals as well as the people of the mill were attacked with illness. This would indicate some common source of infection rather than that the disease was transferred from the animals to man, or *vice versâ*. Both the animals and the inhabitants of the mill used the same drinking-water, and lived on the same waterlogged soil."

xxvii.

Dr. Gresswell's Report to the L. G. B. on the Prevalence of Diphtheria in the R. S. D. of Walsingham, September 24, 1885.

Infection distributed at school by a child convalescent from an unrecognised attack.—On January 18, 1884, a child, J. W., residing at Fulmodestone, was taken ill with a "bilious attack;" she returned to school on February 25, suffering from general debility, weakness of vision, and peculiarities of voice. Owing to defective vision and general weakness she was obliged to cease attendance on March 3. Shortly after February 25 several other households were attacked almost simultaneously with diphtheria, the first patient in each household being a child attending the school.

Chronic diphtheria.—A monitress at Langham school contracted diphtheria from a previous case, and gave up work early in June. She suffered from sore throat several times after this date, markedly on November 9 or 10, when after a few days' illness she again gave up duty. Within a few days of her return after this attack three children in the school were affected with diphtheria.

xxviii.

Dr. Gresswell's Report to the L. G. B. on the Prevalence of Diphtheria in the R. D. of Mansfield, March 15, 1886.

Recurrent attacks of diphtheria and chronic throat illness, in some cases infective.—A girl, aged 16, had diphtheria at Whitsuntide, 1884, and Whitsuntide, 1885, the diagnosis on each occasion being made by her medical attendant. During the interval she had occasional attacks of sore throat, and attributed the second attack of diphtheria to catching cold. Her house was damp, the cellar frequently contained several feet of foul water. No other persons were known to have been infected.

Two separate households in a court in an isolated part of Sutton were attacked by diphtheria; the only source of infection which could be traced was that a child, X., in the same court, and with whom these households had dealings, had had diphtheria the year before, and had since suffered from chronic tonsillitis and chronic enlargement of the cervical glands.

xxix. *Case* 53.

Dr. Gresswell's Report to the L. G. B. on the Prevalence of Diphtheria in the R. S. D. of Erpingham, December 7, 1885.

Diphtheria followed by chronic sore throat apparently capable of producing diphtheria in others.—(*a*) In December, 1881, Mr. and Mrs. F. and A. P., then aged 11, had diphtheria; ever since Mrs. P. and A. had sore throat whenever exposed to cold. A. had severe sore throat in July, 1883, shortly after taking duty as a monitress at Bodham school; this illness was attributed to taking cold, and no infection could be traced. Within a few days three children attending the school fell ill of diphtheria. One of these children infected among others an elder sister, M., who has been subject to sore throat ever since. On December 31, 1883, a Mrs. B. took a child from another village to visit at M.'s house. Mrs. B. was ill next day, and the child died of diphtheria on January 7, 1884. In April, 1885, Miss J., who lived in a detached house near M.'s (also a detached house), and was a friend of M.'s, fell ill with diphtheria. M., when seen in April, 1885, had a strawberry tongue, the left tonsil was enlarged, and the pharyngeal mucous membrane was thickened, with hypertrophied follicles. All these three persons—Mrs. B., the child, and Mrs. J.—had also been in M.'s house, which had not been re-papered since its invasion by diphtheria.

(*b*) In 1879 H. W. had diphtheria, and his mother, two brothers, and a sister suffered later. The next year H. fell ill again of diphtheria and died. Shortly afterwards J. W., aged 2, had diphtheria severely, and ever since, whenever he caught cold, his tonsils swelled, and became covered with a white coating. In August, 1884, when seven years old, J. played truant and returned to school wet and ill; next morning he was pronounced by his medical attendant to be suffering from diphtheria.

(*c*) Mrs. D. had diphtheria in 1868, and ever since had had sore throat, large tonsils, and headache after exposure to cold. For six years before 1882 she had a yearly attack of quinsy, and since the last had suffered every three or four weeks from tonsillar enlargement. In August, 1884, she was disabled by a severe attack of "tonsillitis," which was probably diphtheria; whether she was exposed to infection by diphtheria was not positively known (but she kept a shop). On

December 8 she engaged M. F. to assist her. On December 19 M. F. went home with diphtheria, and died December 24. Two weeks later her brother had diphtheria. Mrs. J. visited Mrs. D. in November, and fell ill with diphtheria two days after (*Case* 53). Mrs. B. visited Mrs. J., took diphtheria (in December), and gave it to her husband. T. F. also visited Mrs. J., took diphtheria, and died. Mrs. D.'s house was small and damp, and there was a large offensive privy vault in contact with the kitchen wall. Mrs. D.'s two children (aged 3 and 11) and her husband did not suffer from sore throat; the children were isolated when she was ill.

xxx.

Dr. Gresswell's Report to the L. G. B. on the Prevalence of Diphtheria in the R. S. D. of Glanford Brigg, August 7, 1885.

Diphtheria and suppurative tonsillitis.—The reporter brings evidence to show (1) that suppuration and diphtherial manifestations may appear in the tonsils side by side; (2) that persons suffering from suppurative tonsillitis are peculiarly prone to catch diphtheria after very slight exposure. In one case, A. D. returned on October 27 to her home, a school at which a child was attending from a house infected with diphtheria. A. D. had suppurative tonsillitis within a day or two of her return, the abscess burst on November 5, and next day she was pronounced to have diphtheria. In another case, Mr. O., subject for many years to quinsy, had suppurative tonsillitis, and a few days later other cases followed in his family. His daughter, who lived at home, was a teacher in a school where several children were in attendance from houses infected with diphtheria. In a third case Mr. S., subject for years to quinsy, had suppurative tonsillitis; the abscess burst, but his throat was soon "as full as ever again," and later he had diphtherial paralysis: he was living next door to diphtherial patients.

xxxi. *Cases* 54 *and* 55.

Dr. Simpson's Report to the L. G. B. on the Prevalence of Diphtheria in the U. and R. S. D. of Wellington, Somerset, May 23, 1885.

Infection apparently conveyed by persons who did not suffer.—L., a girl aged 14, visited a friend who was attacked a few days after with sore throat, and who gave decided diphtheria to another family. L. returned to her home on September 25. This house was a cottage on marshy ground, with an open well liable to contamination, and a large cesspit. On September 26 L.'s brother, aged 10, and sister, aged 9 (*Cases* 54 and 55), became ill with headache and sore throat, and died in four and six days respectively. Other members of the family were subsequently attacked. J., aged 16, came home and slept for two nights with a sick brother; he did not suffer, but a few days after his return to work, at some distance, one of the family with whom he lived was seized with an affection of the throat.

xxxii. *Case* 56.

Dr. Gresswell's Report to the L. G. B. on the Sanitary State of the Aylesbury U. S. D., and on Diphtheria there, July 15, 1886.

Infection probably during a relapse; diphtheria followed by infectious sore throat.—The following is the history of the epidemic investigated. (*a*) In February, 1885, a girl returned home who had had diphtheria in

the previous month while in service; she had a relapse, and was invalided until June. Her brother had sore throat shortly after her return, other members of the family had sore throat later, and the house was not disinfected.

(*b*) In February, 1885, there was a death from croup in Bilston Road, in which most of the children attending St. John's school lived, and there were two cases of diphtheria at a house near this school in May, 1885. When this school reopened on August 31, 1885, the head mistress noticed that a dozen or more children were suffering from throat mischief, with in some instances a considerable degree of malaise, and that for four or six weeks after the reopening other children, in all perhaps thirty or forty, suffered in like manner, chiefly among the girls in the upper schoolroom, who numbered 103. The head mistress considered the affection catching, and herself "took it," and suffered on and off for about three weeks from "an ulcerated sore mouth with ulcers all over the roof of the mouth."

(*c*) The first recognised case of diphtheria was a girl, F. R., attending the British schools, but there was a considerable amount of communication between the children attending the two schools. The servant girl mentioned in (*a*) lived two doors away from F. R., and there was frequent communication between the two families. F. R. was taken ill while at school on October 18, and died October 24.

(*d*) One of the mistresses (*Case* 56) at the British school visited the R.'s on October 28th, and kissed the corpse of F. R. She fell ill of sore throat on October 30. But two of F. R.'s sisters continued to attend school up to October 23rd, and the next two cases occurred in school-children who fell ill on October 31st and November 2nd respectively. The mistress continued at her duties until she fell ill.

The epidemic spread to other schools, and was not extinct at the end of February, 1886, when the inspection was made. The sanitary condition of the town was very defective.

xxxiii.

Mr. George Turner's Report to the L. G. B. on Diphtheria at Dalham, 1886 (unpublished).

Fomites; long persistence of infection.—Mr. Turner mentions a case which had come to his knowledge in which the infection of diphtheria had been preserved in clothes for four months, and quotes account given by Dr. Armstrong, M O.H., of the occurrence of diphtheria in two families in June, 1885, and in June, 1886, which appeared to favour the opinion that the infection might be continued in some way in a family for a year or more, and carried by it into another village on moving from one to the other.

xxxiv.

Mr. George Turner's Report to the L. G. B. on Diphtheria in the village of Farnborough, 1886.

Gravity of disease depending on existence of nuisances in houses.—"Only one death [out of ten] occurred in a house in which serious sanitary defects were not discovered. In fact, as far as the epidemic in this village is concerned, the gravity of the disease has chiefly depended upon the presence or absence of privy nuisances."

xxxv.

Dr. Gresswell's Report to the L. G. B. on Diphtheria at the Royal Female Orphan Asylum, Beddington, April 2nd, 1886.

History of endemic prevalence of "sore throat," "tonsillitis," &c., with occasional cases of recognised diphtheria.

xxxvi. *Cases* 57 *to* 60.

Mr. George Turner's Report to the L. G. B. on Diphtheria in Moulton, November, 1886 (unpublished).

School influence.—The reporter had little doubt that the overcrowded chapel Sunday school was principally responsible for the ease with which the epidemic spread. It probably obtained entrance through a girl, L. S., who did not attend, but lived next door to the school. This girl was sickening with diphtheria on June 7, a Sunday. The next cases occurred as follows:

On June 10 M. B. (*Case* 57), a girl aged 15, L. S.'s cousin, had been in communication with L. S. recently, probably especially on June 7. Incubation period probably three days.

June 11.—W. B. (*Case* 58), brother of M. B., aged 13; incubation period probably four days. R. B. (*Case* 59), brother of M. B., aged 9; incubation period probably four days. A. W. (*Case* 60), a girl aged 6, belonging to a family in which L. S. was nurse; incubation period probably four days.

Other cases followed in the B. and in other families in which the mode of infection was not traced; but the reporter points out that in the week following Sunday, June 21, a series of cases occurred among children attending the chapel Sunday school, viz.:

June 23.—M. S., f. aged 18, incubation period two days, probably. S. B., m. aged 13, incubation period two days, probably. F. P., aged 8, incubation period 2 days, probably. F. F., m. aged $8\frac{10}{12}$, incubation period two days, probably.

June 24.—M. B. and E. B., sisters of S. B., incubation three days, probably.

June 25.—A. F., sister of F. F., incubation period four days, probably.

All or most of these children were attending on week-days at the National schools, in which several cases of diphtheria had occurred before June 21.

xxxvii.

Mr. George Turner's Report on Diphtheria in Petersfield and the neighbourhood, 1886 (unpublished).

Infection by person who did not suffer.—"The infection may have been conveyed in many ways. In one instance the mother of a family assisted in laying out one of the children who died. She does not appear to have suffered, but her children did."

? Infection carried by a person who did not suffer until later.—A lady landed at Portsmouth from Malta on January 4, 1886, and next day went to a house at Grantham. This lady had sore throat on January 10, but it was at first slight, so that she was not seen by a medical man until January 15; on January 16 he diagnosed diphtheria. She had

post-diphtherial paralysis, but eventually recovered. The master of the house, aged 73, had sore throat January 26, and died February 4. His daughter, aged 23, had sore throat February 5 or 6, and died, after tracheotomy, on February 13. In discussing the origin of the specific infection in this case, the reporter states that there was no diphtheria on board the vessel; the lady, L. S., must have been infected either (1) on the journey from the docks to Grantham, or (2) at the house in Grantham. In support of the latter hypothesis it is pointed out that the daughter, aged 23, who suffered last, was known to have visited certain cottages in Grantham Forest, where two fatal cases of diphtheria had occurred. "Is it not probable she may have been the person who introduced infection into the family, although she herself did not present sufficient symptoms to attract attention until so much later; and that until her system had been affected by trouble and anxiety she had been able to resist the disease? The nature of the case renders direct proof difficult, but so many instances have come to my notice in which diphtheria appears to have been commenced in this manner that I think it may be probable."

xxxviii. *Cases* 61 *and* 62.

Dr. Parsons' Report to the L. G. B. on the recent Prevalence of Diphtheria in the Wincanton R. S. D., &c., July 31, 1886.

Incubation periods of not less than seven days.—Several cases of diphtheria occurred among children attending Queen Camel school, which closed on August 14, 1885. Four cases subsequently occurred, one in the village on August 16, and three at Camel Hill, a mile away, two (*Cases* 61 and 62) on August 21, and one a day or two later. "On the supposition that the diseases were contracted at school, the incubation period of the Camel Hill cases would be at least a week, or perhaps more, whereas the usual period is two to five days."

xxxix.

Mr. W. H. Power's Report to the L. G. B. on an Outbreak of Diphtheria at York Town and Camberley (parts of Frimley parish), in the Farnham R. S. D., April 7, 1887.

Milk epidemic; large milk consumers attacked in greater numbers.—The reporter concluded that the outbreak of diphtheria was due to milk which had acquired the quality of infectiveness before leaving the dairy farm where it was produced. There was a very different incidence of the disease upon the wealthier class and the class of cottagers and tradesmen, the former suffering much more than the latter. The following table shows the incidence on families of the several classes residing within the area selected for investigation, and supplied with milk from the dairy farm in question:

	Number of families supplied with the milk.	Number of families invaded.	Invasions per cent.
Wealthier class	44	37	84·0
Cottagers and tradesmen	50	11	22·0

The following table shows the incidence on individuals, members of the families enumerated in the above table:

	Children (0—15 years).			Adults.			All ages.		
	Total.	Attacked.		Total.	Attacked.		Total.	Attacked.	
		No.	Per cent.		No.	Per cent.		No.	Per cent.
Wealthier class .	48	26	54·1	269	79	29·3	317	105	33·1
Cottagers and tradesmen . .	94	6	6·4	145	9	6·2	239	15	6·3

The *amount* of milk supplied to the two classes of families differed. The average amount to the wealthier households was 5·2 pints to each household daily; in the other class the daily average was 0·8 pint to each household. Further, within the same class of households treating their milk in the same manner there was still to be discovered a difference of diphtheria incidence according to the mere amount of milk consumed by the individual. Thus, as regards adults among the wealthier class, "of 217 adults in 41 households described as not being special milk drinkers, 60 (27·6 per cent.) were attacked; whereas of other 32 adults in 21 of the households, who were considerable consumers of milk, 25 (78·0 per cent.) were attacked." As regards children, "Only 10 children in 8 households are recorded as not consuming much milk, and of these no more than one was attacked. But of 33 other children in 18 households, who did consume milk in considerable quantity, 23 (70·0 per cent.) were attacked." Further, "the differing incidence of diphtheria upon milk consumers of one and another rank of life was considered to be very probably due in some measure to a difference in the customary treatment of milk after its reception into the houses of the one and the other class. Thus the cottager and tradesman class did not as a rule keep milk from one delivery to another, or overnight, whereas in the wealthier households it was generally the practice to store up milk, often several pints together, for a greater or less number of hours or overnight. In eleven households in which skim-milk had been consumed the incidence of diphtheria on both adults and children was heavier than in any other group of households of similar size; further, fourteen households of the wealthier class, that denied having kept milk of any sort from one day to another, suffered less diphtheria in their adults and in their children than any other group of equal size of the wealthier class." Mr. Power, however, adds the caution that these households consumed comparatively little milk, and few of them contained many children or milk-drinking adults. Mr. Power, in concluding his report, makes the following observations of importance in connection with the origin and spread of epidemics of diphtheria among the inhabitants of villages, who, as a rule, consume only small quantities of milk:—"The diphtheria among wealthier class consumers was, as regards amount and fatality, so conspicuous that its relation to the milk service was readily seen, but among poor class consumers it was so inconspicuous in amount and fatality that the fact of its relation to the milk service might readily have been over-

looked. It is altogether doubtful, therefore, whether, in the absence of the test of the milk supplied in the persons of wealthier class consumers, the ability of this milk service to cause diphtheria would have been detected."

xl. *Cases* 63 *to* 67.

Dr. AIRY's Report to the L. G. B. on an Epidemic of Diphtheria at Buxted and Maresfield, in the Uckfield R. S. D., July 3, 1888.

Infection conveyed by convalescent patient.—The first cases were two children named M., whose parents kept a roadside inn. The boy, aged 11 (*Case* 63), went to stay in Buxted village, about two miles from the inn, on September 19. He walked home on September 26, and on his arrival about 5 p.m. his father noticed the bad smell of his breath, and saw that he was ill, and went at once for a doctor, who came next day. The little girl, aged 9 (*Case* 64), had seemed sleepy and out of sorts for a day or two before, and on the Sunday evening, September 26, she seemed ill like the boy. On Monday the doctor found them both suffering from diphtheria. They both recovered. There appears to have been no doubt as to the nature of the disease, but the source of infection was not ascertained. It can hardly be doubted that the two children must have contracted the disease from one and the same cause at the same time, while they were together on or before Sunday, September 19. The girl,* when convalescent (about three weeks from the date of the attack), went to stay at the same house in Buxted as her brother had visited before the illness; soon after her arrival at Buxted, a little delicate boy, between three and four years old, a visitor to the village, who was known to have been at play with her, though only out of doors, sickened with diphtheria on October 21, was taken home on October 24, and died on October 28. On the day of his death a younger child of the same family was taken ill, and died on November 1. This family lived within a mile of the village, at a small farmhouse.

Infection conveyed by children who did not suffer.—Two of the M. children, aged 7 and 5, who had escaped diphtheria, returned to school (at Hurstwood) on October 25. On October 31 a boy aged 14 (*Case* 65), attending the same school, was taken ill. He had met the two M.s, and they had given him an apple. He was the son of a gamekeeper, living in one of a pair of new houses in an out-of-the-way spot.

Probable conveyance of infection by patient in incubation stage.—Five Ash Down is a cluster of houses two miles from Hurstwood and a mile from Buxted. At both of these villages there had been diphtheria, and some of the Five Ash children went to Buxted school. One family, P., attacked in April, 1887, almost simultaneously with the other Five Ash families, however, sent their children to Maresfield school, a mile and a half in the opposite direction to Buxted. Within two days after the first attack in P.'s family, a boy named C., living in Maresfield village and attending Maresfield school, was taken ill. It was noted that he sat in school next to one of the P.s, but not the one who was first attacked. If C. caught diphtheria through the P.s, it must have been during the incubative period of the latter. The possibility that the

* It is worthy of note that the boy went to stay with his grandmother, and slept with a sister who was staying in the grandmother's house, but neither this sister nor any one else in the house took the disease.

infection may be conveyed in the clothes of these children cannot be altogether rejected.

Infection preserved in clothes.—With the exception of one case in October contracted elsewhere, there had been no diphtheria in Five Ash Down from May to December, 1887. In December a family of delicate children, living next door to—and under the same roof with—a family that had suffered in April and May, was attacked with diphtheria. It was naturally supposed that this was in some way a revival of the old infection, and on inquiry Dr. Airy found that some clothing from the previously infected house—clothing that had belonged to victims of the disease—had been purchased by the neighbour whose children were afterwards (though not till some weeks afterwards) attacked with diphtheria.

Infection by short interview with convalescent patient; incubation period six days.—The schoolmaster at Maresfield (*Case* 66) had an attack of the disease in November. There was no infection, so far as is known, among the school children or in their homes at that time. The only explanation that could be offered was that six days previously he had met in the open road, and patted on the shoulder, a boy who had been ill in the latter part of October, and was just beginning to get about again.

An outbreak occurred in August, 1887, at Heron's Ghyll school, on the high road about two miles beyond Five Ash Down and 200 feet higher up towards the forest. The first family attacked resided in an out-of-the-way cottage, situated in a hollow near a brook. A week previously the child—a girl aged 13 (*Case* 67), who was the first attacked—had been to Hurstwood, where there had been diphtheria, to a little general shop there, but it was not known that any case of the disease remained in Hurstwood at that time.

xli.

Dr. Airy's Report to the L. G. B. on an Outbreak of Diphtheria at Haslemere, in Surrey, &c., August 12, 1887.

Example of transmission by unrecognised cases.—There was diphtheria at Shotter Mill school during and after January, 1886. Two families, Brown and Smith, resided in adjoining cottages at Clay Hill, halfway between Haslemere and Shotter Mill. The Brown children went daily to Shotter Mill school, the Smith children to Haslemere school; the children of the two families were often together at home. One of the Brown children was attacked in May, and died on May 25; another sickened later, but recovered. Some time in June the Smith children sickened with similar symptoms (the mother said) to those of the Browns, especially vomiting and headache; one of the Smith children was in bed three days, the other one day. "A doctor was called in, who (the mother said) at first thought the children had diphtheria, but afterwards, when they speedily recovered, ascribed the sickness to the heat of the sun." Smith's children went to the Haslemere infant school, and "the first undoubted case of diphtheria in Haslemere was that of a pupil-teacher at that school, who remembers the fact of one of the Smiths having sore throat. She was taken ill on July 4."

xlii. *Cases* 68 *to* 70.

Dr. Parsons' Report to the L. G. B. on the recent Prevalence of Diphtheria in the city of Winchester, April 25, 1887.

Infection through a common drinking vessel.—X., a man employed at a workshop, had a sore throat and stayed at home for a few days. On the day of his return to work his employer asked him and two other men (*Cases* 68 and 69) to help in carrying a cask of ale into the house, rewarding them with a mug of the liquor between them, of which X. drank first, followed by the two other men. Both of these latter were taken ill two or three days later, and one of them had a distinct attack of diphtheria, followed by paralysis of the soft palate.

A little girl came from a town where diphtheria was prevalent to Winchester, and was taken ill next day with diphtheria. A week later her mother, who came with her, and a servant (*Case* 70) of the household to which she was on a visit (both of whom had nursed her), were taken with the same disease.

Epidemic sore throat in a school succeeded by diphtheria.—Three children. C., who had had "colds," attended a school at its reopening on September 14. On September 22 A., a little girl attending the same school, stayed away from school on account of sore throat. She returned on October 4, and a few days after this the schoolmistress noticed that A. and two of the C.s were suffering from an affection of the eyesight, which, she said, "seemed to be infectious." This affection was found to be paralysis of accommodation. B., a great friend of A.'s, was taken ill on October 16 of undoubted diphtheria, followed by inability to see near objects. Other cases of "sore throat" followed in A.'s family. In another instance a child who died of diphtheria was probably infected by another who had no medical attendance, but had been feverish, with dysphagia and white spots in the mouth.

xliii. *Case* 71.

Mr. Spear's Report to the L. G. B. on the continued Prevalence of Diphtheria in the Aylesbury U. S. D., December 15, 1888.

Two outbreaks of diphtheria connected by prevalence of sore throat.—This report deals with the reappearance of the disease after nine months' interval of almost entire freedom, and is in continuance of Dr. Gresswell's report of 1886 (see No. xxxii). Mr. Spear found the endemic prevalence of diphtheria in Aylesbury* co-existed with a condition of sewers and drains that was productive of excessive filth contamination of soil and air. The epidemic which began in 1885 continued after Dr. Gresswell's report, but extended very slowly after March. From July 15, 1886, to April 11, 1887, no fatal case of diphtheria occurred, and only three non-fatal cases could be heard of; one of these occurred in August and two in October. The fact of this intermission could be affirmed as regards *recognised* diphtheria, but "simple sore throat" had prevailed throughout the winter of 1886–7; catarrhal rhinitis, likewise, with some offensive discharge, was stated to have been common during this period. As to the diphtherial nature of the catarrhal affections that were thus interposed, Mr. Spears writes, "The absence throughout a long series of cases of the distinctive appearances of

* Deaths from diphtheria in Aylesbury: 1880, 0; 1881, 1; 1882, 2; 1883, 1; 1884, 0; 1885, 15; 1886, 16; 1887, 27.

diphtheria, the freedom from fatality and from characteristic sequelæ, must be allowed weight. On the other hand, when diphtheria prevalence was again established, although that of 'simple sore throat' had been diminished, several cases of illness occurred, not distinguishable, it is said, from the apparently simple affection, except for characteristic sequelæ; and here and there unequivocal cases of diphtheria were associated, apparently causally, with attacks that from a clinical standpoint alone would be considered non-specific."

The clinical features of these cases of sore throat did not differ from those of erythematous or follicular tonsillitis. The small white or yellowish specks on the swollen and hyperæmic mucous membrane of one or both tonsils, common to that affection, never, it was said, assumed the appearance of the thick continuous membrane of developed diphtheria, and disappeared after one or two days' duration; slight follicular erosions of the tonsils were frequently seen. The lymphatic glands were often enlarged and tender, and for a day or two constitutional disturbance was present. Albuminuria, in the few cases in which it was looked for, was never observed. General debility of some duration frequently followed these attacks, but distinct paralyses were absent. Children and young adults were attacked in largest proportion, and occasionally several members of a family suffered simultaneously, or more often in rapid succession.

Diphtheria in 1887–8 tended to recur in the same localities as had been infected in 1885–6. In the first epidemic the streets contributing the total mortality contained 529 houses, or an estimated population of 2710, so that the death rate was 11·4 per mille of the street population; in the second epidemic the mortality rate was equal to 6·3 per mille of this population, whereas in the remaining streets the corresponding ratio was 2·3. Further, diphtheria tended to recur in the same houses. "Nine houses invaded during 1885–6 were again, in the outbreak of 1887–8, the seat of disease. In other words, estimating the number of infected houses in the first outbreak at eighty,* even at this high computation their inmates suffered during the recent epidemic more by 60 per cent. than the rest of the inhabitants of infected streets, or to somewhat more than twice the extent of their fellow-townspeople generally. Again, during the progress of the last epidemic the disease made its appearance twice, by two apparently separate and distinct invasions, in eight houses the interval between the first and second ranging from three to ten months (in three cases, three to four months; in three, four to five months; in one, six months; and in one, ten months). Before the second appearance of the disease the house had in each case been apparently free from infection for some weeks at least. In ten cases the disease was found to have made its appearance next door to houses invaded during 1885–6. In two of these cases, however, the disease had meanwhile reappeared in the house next door (the one invaded in the earlier year); the interval between the second invasion of the one house and the first of the other being, in the two cases, five days and four months respectively."

No evidence of family predisposition was obtained which would serve to account for these recurrences; and as to individual predisposition, in

* As only thirty-seven houses are known to have been infected down to February 21, 1886, by which time six tenths of the mortality had occurred, this estimate is probably too high.

only one case did the disease start definitely a second time in the person of a previous sufferer. The reappearance of the disease in these houses, therefore, was not due to persistent cases of chronic diphtheria. Mr. Spear writes, "The histories I have obtained lead me to believe that chronic cases, or cases attended by relapse so as to cover a long period of time, and at last perhaps proving fatal, may occur; but in the instances of 'recrudescence'* I have given such explanation was, I think, sufficiently excluded."

Incubation period of five days.—At Oving a girl aged 14 (*Case* 71) "sickened with diphtheria on November 13, 1887, and died on the 24th; her brother was seized on that day, and died on the 30th. The medical man in charge of the cases after performing tracheotomy was likewise attacked. No other cases of diphtheria were known of in the neighbourhood. The first sufferer had for some time only been away from home once, and then to a tea party held on November 8 in the Corn Exchange, Aylesbury, *i. e.* five days before definite symptoms of infection were observed."

Infection conveyed by unrecognised case.—At Weedon there was a good example of conveyance of infection by an unrecognised case. A boy attending school at Aylesbury had a bad cold, with fœtid nasal discharge, but received no medical attention. Before he recovered his sister sickened and died of diphtheria in four days.

xliv.

Dr. Bruce Lowe's Report to the L. G. B. on Epidemic Diphtheria in the Enfield U. S. D., April 23, 1888.

Milk epidemic.—"The complete indifference to locality here shown by the diphtheria as regards its exceptional incidence on consumers of the particular milk, and its fatality to such persons when attacked, accord with previous experience of milk diphtheria. . . . Of 51 cases reported, over 80 per cent. had been taking this milk, as also had every one of the cases which proved fatal." Of about 210 houses in a particular area taking the milk 21, or 10 per cent., were attacked;

* Mr. Spear gives the following instance of recrudescence. In Northern Road (a small private street of twenty-three houses, in which five cases of diphtheria and two deaths had occurred in the epidemic of 1885–6) two children of one family fell ill during the first week of May, 1887. They were both attending the British school, but only one case of diphtheria, and that a month earlier, had up to that time occurred amongst their schoolfellows. The children recovered, and on June 6 were both attending school again. On September 23 another child of the family, not attending school, was attacked by diphtheria. I could hear of no exposure to infection since her sister's illness, nor could I learn on careful inquiry of any other case in this street during the interval of some four months that had elapsed. A fortnight later a young child of another family in the row sickened, and died after five days' illness. The house first invaded was apparently free from infection once more, and the school children were again attending school, when, about November 8, the baby, aged 18 months, sickened; another child, aged 4, not attending school, was seized on November 12 and died on November 23. A child belonging to another family in the road, a pupil at the British school, fell ill on the 21st of the month. The house where these recurring outbreaks occurred is, it may be remarked, damp, and, owing to drainage defects, exposed to sewage effluvia; the street itself is unmade, sloppy, and neglected.

of about 690 in the same area not taking the milk 5, or 0·72 per cent., were attacked.

Cats.—A little boy had a fatal attack of diphtheria. On the first day of his illness he vomited, and the cat licked the vomit on the floor. In a few days (and after the death of the boy) the cat was noticed to be ill, and her sufferings being so severe and similar to those of the dead boy the owner destroyed her. During the early part of its illness this cat was let out in the back yard; a few days later the cat of a neighbour who lived a few doors off was noticed to be ill. This cat also had been out in the back yard at night. This second cat recovered, being carefully nursed by four little girls, all of whom developed diphtheria. There was no other known source of infection to which these girls had been exposed but their cat.

xlv.

Mr. Spear's Report to the L. G. B. upon the Prevalence of Diphtheria in Farnham R. D., &c., April 23, 1889.

Infection conveyed by patient two and a half months after attack.—A long series of cases of diphtheria occurred among children attending Sarisbury Green school, in which insanitary conditions existed. The summer holidays commenced on June 30. Within a day or two of this date one of the school children, who lived in an isolated cottage two miles away, sickened with diphtheria. About the middle of September this child was sent to a little school at Warsash, two miles from her home in the opposite direction from Sarisbury. Another pupil at Warsash, a companion of the child, sickened of diphtheria about October 1, and subsequently four other families in the village were infected.

xlvi. *Cases* 72, 73.

Dr. Parsons' Report to the L. G. B. on the Prevalence of Diphtheria in Kilkhampton, in the Stratton R. S. D., Cornwall, September 6, 1888.

Diphtheria preceded by a prevalence of sore throats at a neighbouring village, and accompanied by prevalence of sore throat in the village itself.—In the neighbouring village the cases of ulceration of tonsils with glandular swelling were very numerous, but none were fatal. In Kilkhampton twenty-eight cases of sore throat were heard of in the same houses as the diphtheria cases, or in households in communication with them. The diphtheria was in all probability spread in Kilkhampton by personal intercourse. In several instances the cases of diphtheria had been preceded by cases of sore throat not recognised as of specific nature. In two households diphtheria seemed to have been associated with scarlet fever, the patients were attacked about the same time, and were suspected to have met. In one household "the first case is stated to have begun as diphtheria, having a small white patch on the tonsil with external swelling; in about a fortnight a scarlet rash broke out. A second and third case of diphtheria followed, both mild and with no rash. These were followed in two other members of the family by attacks of scarlet fever without diphtheritic membrane, and of one patient the skin was still peeling at the time of my visit. In the other family a servant had had 'ordinary sore throat,' with a little redness about the tonsils, but no rash. A few days later, a girl aged 11 was taken ill with vomiting, headache, and sore throat; a

scarlet rash appeared on the third day and was followed by copious peeling, but there was also a deposit of diphtheritic membrane on the throat. The attack was followed by one of rheumatism. A younger child had a slighter attack." In no case in this Kilkhampton outbreak were any paralytic symptoms noticed.

Incubation supposed to be fourteen days.—In two cases it was locally believed that the period of incubation was fourteen days. (1) A boy (*Case* 72) residing in an outlying house spent some part of a day at his aunt's house, in which a boy was then lying ill of diphtheria. Fourteen days later this child was attacked with diphtheria. (2) In this case (*Case* 73) there seemed to have been other opportunities of contracting infection subsequent to the one a fortnight before.

xlvii.

Dr. Parsons' Report to the L. G. B. on an Outbreak of Diphtheria at Llanara and Whitford, in the Holywell R. S. D., October 2, 1888.

Diphtheria in children preceded by scarlet fever in them, and by sore throat in adults.—Five households were invaded, two in January, two in April, and one early in May. Only two of the houses were near together, viz. one of those invaded in January and one in April. The houses were all on high ground, and scattered along a course of about four miles from east to west. The first four houses invaded were small old farmhouses or cottages. The milk supply was different in each case, and in no case could any disease of domestic animals be heard of in connection with the cases of diphtheria. In the first house invaded no means were heard of by which the disease could have been introduced from elsewhere, but the father, a quarryman, had had an illness attended with some sore throat, but stated by the medical man who saw him to be rheumatism; a neighbour also had had "quinsy," to which he was liable. The patients who had diphtheria in this family were children who had all suffered from scarlet fever shortly before, and had gone out and "caught cold."

Persistence of diphtheria in a family.—The fifth house invaded in May was of a different class; it was a large Hall, two miles from either of the others, in an open dry situation. The family had previously suffered from diphtheria and lost one child when living in Holywell; a defective water-closet was suspected as having had to do with the outbreak. In 1884 they removed to the large house above mentioned, and thereafter had suffered from time to time, and on some occasions several at one time, from sore throats characterised by ulcers on the tonsils, &c., with sloughy surface and red angry base, or occasionally small patches of false membrane; one little girl who had enlarged tonsils was most frequently affected. In June, 1885, this little girl had a distinct attack of diphtheria, as also did another daughter in May, 1888. At the latter date, and also in the previous December, several other members of the family suffered from sore throats of the kind previously mentioned. On examining the house the drainage was found to be ill-arranged.

xlviii. *Case* 74.

Mr. Spear's Report to the L. G. B. on an Outbreak of Diphtheria in the Llandissilio Reg. S. D., Pembrokeshire, September 28, 1888.

Incubation seven days; infection contracted by dogs (?) and conveyed to children (?).—An outbreak of diphtheria in an agricultural district,

Importation not traced. Affected chiefly two villages, which were almost continuous. At both villages there were gross insanitary conditions, especially in connection with disposal of refuse and excrement. The infection was only active in this the original focus. Cases occurred in the small town of Narberth, in houses having much better sanitary surroundings, and did not spread. All these cases, with two exceptions, occurred among people who had visited the infected villages. The following were the cases in Narberth:—(1) A woman who, a few days before her illness, visited an infected family in one of the before-mentioned villages; she had four children, but neither they nor any other member of her family suffered. (2) A tradesman of Narberth (*Case* 74) visited one of the villages, and was attacked just one week later. (3) A servant maid had sore throat a few days before the return of a child of the family. The child was attacked with diphtheria a fortnight later. (4) Two children of Dr. P., of Narberth, who was daily visiting cases in the infected villages. He was accompanied on his rounds by two terriers; these dogs' "attentions to the patients and to the patients' food supply were so marked as to necessitate, on one occasion at least, their expulsion from an infected house." These two dogs subsequently exhibited symptoms attributed by Dr. P. to diphtherial infection—feverishness, drowsiness, constant efforts to clear the throat, &c. Subsequently two cats developed similar symptoms. Dr. P.'s two children were both attacked on the same day, "about ten days after the canine seizures." The two children suffered severely. Dr. P. had "some slight sore throat" at a date not specified

xlix.

Dr. Parsons' Report to the L. G. B. on an Outbreak of Diphtheria at Llanwddyn, Montgomeryshire, October 9, 1888.

Infection conveyed by bedding.—In speaking of the difficulty of tracing or excluding personal contagion, Dr. Parsons states that in two households outbreaks of diphtheria followed the use of a bed, given by a neighbour, upon which a diphtheria patient had slept. In both instances this circumstance was first heard of casually from neighbours.

l.

Dr. Blaxall's Report to the L. G. B. on an Epidemic of Diphtheria at Midsomer Norton, &c., September 4, 1888, and Annual Report.

Infection carried by unrecognised cases.—There had been a good deal of sore throat, ulcerative in character and offensive, during the winter months, and there had been diphtheria in two neighbouring villages. The first case of diphtheria in Midsomer Norton came under care on April 30, the second (in the same house) on May 4. The first case was taken ill April 27, and died May 2. In thirteen out of fifteen families first attacked the first sufferer was a child at the chapel school, and inquiry showed that diphtheria and suspicious sore throat had been in the school before April 27. Certain of these unrecognised cases of "suspicious sore throat" subsequently developed paralyses. No communication could be certainly established with antecedent cases in the two other villages, "but," Dr. Blaxall writes, "it may be a question whether these cases of sore throat afford examples of progressive development of sore throat into diphtheria, which has been spoken of by certain authorities. I see, however, no evidence in favour of this hypo-

thesis, observing that cases of sore throat, however trivial, are shown to be already of diphtheritic nature if they are followed by the characteristic paralysis of the disease."

li. *Case* 75.

Dr. AIRY'S Report to the L. G. B. on a Prevalence of Diphtheria in the Northern Outskirts of Norwich, in 1887–8, December 2, 1888.

Infection probably from a foul catch-pit.—The suburbs of Norwich extend into the parish of Catton. The epidemic in Norwich was probably started and maintained in connection with sewer nuisances. Cases occurred towards the end of April, 1888, in Hellesdon Road. On July 10, a lad (*Case* 75) nearly 15 years old was employed by a cow-keeper in the Hellesdon Road to empty out the catch-pit adjoining the cow-shed. He was "overcome" by the stench, was taken suddenly ill, and obliged to go home. He lived at an isolated cottage in the open country; his father was a shepherd. Diphtheria developed rapidly, and the lad died July 15. A child of four in the same family died nine days later. The father and two other children had it severely, the mother and two remaining children slightly. Nothing is stated as to the health of the cows. It was impossible to prove that the boy had not contracted the disease before beginning the work at the catch-pit. Dr. Airy speculates as to the possibility of the urinary and fæcal drainage of a cow-shed becoming the vehicle of the poison of diphtheria, and as to the infection of filth heaps and filth pools and filthy drains over a certain area serving as the focus in which the poisonous influence maintains itself.

lii. *Cases* 76 *and* 77.

Dr. PARSONS' Report on a recent Prevalence of Diphtheria in the Parishes of Roche and St. Stephens, in the St. Austell R. S. D., Cornwall.

Variation in length of incubation after exposure under identical circumstances.—There was evidence that the susceptibility to diphtheria varied greatly in different persons. Thus in one family in Roche, not worse housed than their neighbours, three out of four of the younger inmates contracted diphtheria, and two died; while in other instances a single case only occurred in a crowded family of children. In one instance three young girls of different families went out for a walk together one Sunday. One of them had just recovered from diphtheria, and her throat was still sore. The two other girls (*Cases* 76, 77) were both taken ill of diphtheria in the course of the week, one on Tuesday, the other on Thursday.

liii. *Cases* 78 *to* 81.

Dr. PARSONS' Report to the L. G. B. on certain Outbreaks of Diphtheria in the Leek R. S. D., Staffordshire, December 21, 1889.

Diphtheria in a few scattered households in a hilly, sparsely populated district.—At Bradshaw all the members of a stone-mason's family except the mother suffered. The first case was a child who died December 2, 1888; a second child began to be ill December 1. The three remaining children were taken to an adjacent empty house and looked after by the grandmother. One of them (*Case* 78) sickened on December 10. At Wicken Walls the first case was a girl aged 11 (*Case* 79), who sickened March 18, and died March 30, 1889. On

March 15 she had taken refuge, for an hour or more, from a snowstorm at the house of a Mr. G. In this house was at the time a boy who had been taken ill on March 9 with diphtheria. The boy and girl attended the same school, but she had not been there for a fortnight on account of the bad weather. At Warslow the first case was a girl who sickened on August 17, 1889. On August 21—four days after his sister sickened—her brother P. (*Case* 80) sickened; the cases were first seen by Dr. A. T. Bury on August 22. The boy then had diphtheria, and died August 29. The girl recovered, but had paralysis of pharynx. A little girl, L. (*Case* 81), daughter of a neighbour, had played with P. up to the day he was taken ill (August 21), after which she was kept strictly apart from that family. She was taken ill August 25 (not less than four days after cessation of exposure), and when seen on August 28 had diphtheria; she died August 31.

Dr. Parsons states that "in all the households attacked the inmates were living exposed to the influence of grave insanitary conditions, and in almost all the localities the first case was a person who had possibly been exposed to the infection of scarlet fever or measles. In some of the outbreaks a rash, somewhat resembling that of scarlet fever, and followed by peeling of the skin, was observed. Symptoms of diphtheritic paralysis followed several of the cases, including one in which a red rash had appeared."

liv.

Dr. Airy's Report to the L. G. B. on an Outbreak of Diphtheria at Great Dunmow, dated August 20, 1883.

Diphtheritic disease and scarlet fever.—During this outbreak there was, in at least two localities, a concurrence or confusion of scarlet fever and diphtheria. In the one case the facts are not clear, but in the other a servant girl, L., who had caught scarlet fever at Beckenham, and had been treated at the Islington Fever Hospital for seven weeks, went home on April 14 to an isolated farmhouse which had been converted into two labourers' cottages. The sanitary surroundings were bad (farmyard filth, water from a pond). Eight days after her arrival—on April 22—one of her sisters, aged 14, was taken ill and died on April 24, death being certified to be due to "malignant sore throat." On April 23 three more of the family, aged respectively 12, 9, and 3, were seized with the same complaint; one died April 25, another April 26; the youngest, after apparently being about to recover, relapsed, and died May 4. This death was certified as due to diphtheria, and medical attendant the considered that all the deaths were from the same disease. A child in the next house but under the same roof had sore throat April 24, and rash of scarlet fever April 30, followed by desquamation on chest, legs, and arms. A woman residing a quarter of a mile away, who came to help in nursing the sick children and laying out the dead bodies, was attacked with diphtheria on April 29, and died, while sitting in her chair, on May 2. It should be noted that there was a simultaneous prevalence of true diphtheria at Dunmow, six miles away.

lv.

Dr. Parsons' Supplemental Report to the L. G. B. on the Continued Prevalence of Diphtheria and Scarlet Fever in the Sutton-in-Ashfield U. S. D., dated May 8, 1883.

Simultaneous prevalence of diphtheria and scarlet fever.—Scarlet fever and diphtheria had for some time existed side by side in Sutton, and in some cases the one disease appeared to be contracted from the other. In some cases the first patient in a family was taken ill with vomiting, sudden accession of fever, red rash, and other symptoms of scarlet fever; but other members of the family, taken ill a few days or a week or two later, suffered from what was pronounced to be diphtheria, having no red rash, but white patches on the throat, and in one or two instances subsequent paralysis of the muscles of the pharynx. In other instances the children of neighbours who had associated together had had at the same time, some what was called diphtheria, others what was called scarlet fever. One boy who was taken ill apparently with diphtheria, having white patches on the throat, after three or four days developed the rash of scarlet fever, which was followed by anasarca, of which he died. On the other hand, in one family in which four members had suffered from scarlet fever in November, two children had diphtheria in January, viz. one who had had scarlet fever in November and one who had escaped; the cases both of scarlet fever and diphtheria were typical.

lvi.

Dr. H. F. Parsons' Report to the L. G. B. on the Recent Prevalence of Scarlet Fever and Diphtheria in the Thorne Registration District, August 8, 1883.

Simultaneous prevalence of diphtheria and scarlet fever.—Dr. Parsons remarks that the relation of diphtheria to scarlet fever was, during this epidemic, very close. He found no room to doubt that the cases recorded as diphtheria were correctly so described, and "many cases were followed by the local paralysis characteristic of diphtheria." Yet in certain cases "what was called diphtheria appears to have been contracted from a case called scarlet fever, and *vice versâ*: members of the same family have suffered, one from the one disease, others from the other; and in four of the fatal cases the same individual is certified to have suffered from both. Throughout the epidemic the type of scarlet fever appears to have tended towards throat complications." Thus of the 82 fatal cases there were prominent throat complications in 20. Besides the above there were 5 deaths from "croup" associated with scarlatina in other members of the family, 14 from diphtheria, 11 from "scarlatina with suppressed eruption," 14 from "scarlatina maligna." Seven cases were followed by fatal kidney symptoms, and one patient died on the fourteenth day from syncope. "The close connection," Dr. Parsons adds, "between diphtheria and scarlet fever has been noticed in all parts of the district, and in the practice of various medical men. It appeared to me that the disease had tended more to assume a diphtheritic character in houses where there were local unsanitary conditions, such as defective and untrapped drains, and foul privy middens." The following are among the cases given in illustration of these remarks:

(*a*) E. T., aged 10, of Epworth, died there of diphtheria on November 29. No other diphtheria at Epworth. Her married sister, whose son

was ill with scarlet fever, had come to the house several times before her illness.

(*b*) In the family of F., at Thorne, there were during April, 1883, three cases of diphtheria and one of scarlet fever, viz. (1) A lad aged 16, who had diphtheria; (2) a girl aged 2, who died on April 8 of diphtheria; (3) a girl aged 12, who died on April 28 of scarlet fever; (4) a girl aged 14, who recovered from diphtheria, but whose sight was subsequently dim.

(*c*) A little girl, W., aged 2, had typical scarlet fever shortly after associating with a child sickening with that disease. This was in September, and on November 6 an apprentice, aged 17, of W.'s father, who worked in a room into which W. after her recovery used to come, sickened with diphtheria, of which he died on November 13. His mother, with whom he resided, subsequently suffered from diphtheria followed by paralysis of the legs and pharynx. In the house at which they lived was a scullery sink with broken bell trap.

lvii.

Dr. Parsons' Report to the L. G. B. on Diphtheria in the Newport Pagnel R. D., dated May 12, 1884.

Special characteristics of "diphtheria" accompanying scarlet fever.—In this district an epidemic of very mild scarlet fever was followed apparently by an epidemic of severe diphtheria. In certain cases, which occurred, however, for the most part in the winter after diphtheria had broken out, the medical men noticed rash, peeling of the skin, and other symptoms of scarlet fever, with an exudation on the fauces closely resembling that of diphtheria. In these cases paralytic sequelæ were not noticed, and all recovered, though one boy subsequently died of croup. At the houses in which these cases occurred, offensive untrapped or defectively trapped drains were found. As further instances of a possible relationship with scarlet fever, Dr. Parsons mentions two cases. (1) A girl had scarlet fever contracted at school. A few days later her sister, aged 22, had a sore throat with white patches and swelling of the glands of the neck, considered to have been diphtheria. She had not fully recovered her voice on March 20, a month after the attack. In the house offensive smells from ill-trapped sinks were complained of. (2) In a row of houses in which previously there had been much scarlet fever two cases of diphtheria occurred in adjoining houses. Here, again, there were ill-trapped sinks in the houses. In this outbreak the infectious character of diphtheria was not well marked. In only three out of the twelve houses were there multiple cases; in four the first case was an adult, and it did not specially attack children attending any particular school.

lviii.

Mr. R. D. R. Sweeting's Report to the L. G. B. on Prevalence of Scarlet Fever, Diphtheria, and "Fever" in the Sandal Sub-district of the Wakefield R. D., May 21, 1885.

Simultaneous prevalence of diphtheria and scarlet fever.—"The following interesting clinical facts are reported to me as having been observed during the epidemic by Mr. Mackenzie [at Normanton]:—(1)

The co-existence of scarlet fever and diphtheria in the same subject. (2) Cases of undoubted scarlet fever, with transient but typical diphtheritic patches on the tonsils. (3) Diphtheria following scarlet fever in the same subject, and *vice versâ*, but more usually the former. (4) The two diseases following each other in the same house in different members. (5) Different members being attacked coincidently, some with one, and others with the other disease." "There were many examples of throat illness without exudation occurring as apparent links between true diphtheria cases. There were also histories of infection from cases of so-called 'cold.'"

lix.

Mr. R. D. R. SWEETING's Report to the L. G. B. on Diphtheria in Hertfordshire, April 24, 1886.

Animals.—An epidemic in Braughing was mainly due to personal communication. The second case was W. P., brother of the first case, C. P., the source of whose infection was not traced. There was at about this time (December) a highly fatal disease ("snick-ups") among fowls on two farms in the village. W. P. worked at these farms. It is suggested as possible that W. P. infected the fowls. In the following March two families who got their milk from this farm suffered from diphtheria. Later the following attacks occurred:—(1) A man worked at another farm where a similar disease prevailed among the fowls; the family got their milk from the farm; the children visited the farm one day, and about a week after, one of them began with diphtheria, and three others had it subsequently. (2) Seven children living on or near a farm, and drinking milk from it, had diphtheria in May, June, and July. The first to be attacked was a baby, who had never been to the village where diphtheria was, and drank much milk; it belonged to the family which lived near but not on the farm. This child was ill in May, two other children of the same family in June, and the farm children in July. The fowls on the farm had the diphtheritic disease.

lx.

Mr. R. D. R. SWEETING's Report to the L. G. B. on the Prevalence of Diphtheria in the Whixley Sub-district of the Great Ouseburn R. D., August 29, 1889.

Diphtheria and drain cleansing; diphtheria and sore throat.—"Once established in Whixley, diphtheria, or throat malady that must be regarded as essentially diphtheritic, was spread from person to person . . . . by people from infected houses meeting together at chapel, by children who were suffering from mild and unrecognised attacks, termed variously 'bad cold,' 'swollen neck,' and the like, playing with other children on the village green. . . . Further, a second attack in a house, where three months before four cases of diphtheria had occurred, took place at a time when the drainage was being reconstructed, and foul old brick drains were being taken up." Two instances are given of wounds becoming affected. In one—that of the medical man, who had a small abrasion only of the finger—there was consecutive paralysis.

Case 82.

Communicated by Dr. W. SQUIRE (published in *Epidemiological Society's Transactions*, vol. iii, p. 538).

In the family of a doctor of medicine a housemaid was taken ill with sore throat and fever on July 17, 1874. On July 23 one of the two children of the family was sent away. On July 30 the two children, the one at home and the other away from home, were taken ill with fever, followed by exudation on the tonsils and fauces.

Cases 83 *to* 87.

Communicated by Dr. ARTHUR WHITELEGGE, Medical Officer of Health to the West Riding County Council.

"A woman (*Case* 83) visited a house where a friend lay dead from diphtheria, and kissed the corpse. This was the only visit, and the only known exposure to infection. The visitor was taken ill five days later with diphtheria."

"A woman nursed a child who died after about a week's illness from 'croup and congestion of the lungs,' a diagnosis which, by the light of subsequent events, was altered (by the medical attendant) to diphtheria. A brother of this child became ill about the same day as the first case died, and he had a mild but distinct attack of true membranous diphtheria. The woman who had nursed the first case returned to her home when the child died (August 15, 1885); her own child (*Case* 84) was taken ill with diphtheria August 22, and died August 28. She had not visited her home while nursing the first case, nor had her child come to the sick house. No precautions were taken to avoid carrying infection, as the disease was not known or apparently suspected to be infectious—'only croup.' This is the clearest case of convection of diphtheria that I remember meeting with."

"A series of cases in a household may help to fix a date of maximum incubation. *Case* 85. A girl, aged 9, became ill with diphtheria on June 10, 1885; was isolated on June 12; considered convalescent and allowed to rejoin the household on June 21. The premises were disinfected. All drainage defects had been remedied during this illness. *Case* 86. A sister, aged 6, became ill with diphtheria on June 29, and was isolated at once; isolation ended on July 15. The premises were again disinfected. *Case* 87. An aunt (adult) became ill with diphtheria on July 21; she was isolated at once and until August 7. Another case occurred on August 15, and subsequently a fifth, but the isolation not unnaturally grew lax, and the dates are not material. The intervals suggest an incubation of about six days. I ought, perhaps, to add that a playmate of the first child's, living near, was taken ill with diphtheria June 16; last contact June 9 or 10."

ENTERIC FEVER.

THE difficulty, in many cases, of determining the exact date at which an attack of enteric fever commences is, as is well known, very great. The earlier symptoms differ very much in severity in different cases, and, apart from this, differences in personal character and temperament lead some persons to continue about and at work for many days while suffering from symptoms which would have led others to seek medical advice. This source of fallacy must be constantly kept in view, but especially in examining cases in which an unusually prolonged period of incubation is reported.

The histories of the epidemics which are given in the succeeding pages offer examples of the various modes of infection observed in enteric fever.

In a minority of cases the person infected had been for varying periods in personal contact with a patient suffering from or convalescent from the disease.

The other sources of infection include—

Pollution of water-supply by the patient directly, or indirectly by soakage from cesspools or leaky drains.

Pollution of milk by specifically polluted water used for adulteration, or for washing milk cans, and pollution of milk by air (?).

Infection conveyed by clothes—observed especially among washerwomen; pollution of well water by drainage from laundry.

Air.

Contamination of food by (?) air.

Incubation Period.

The following table contains all the cases in which the duration of exposure to infection was for a known short period,

and those in which infection was derived from consumption of infected water, milk, or food on a single occasion :—

Report	No.	Source of infection.	Interval before first symptom.
x	6	Milk	5
xxxii	53	Water	8 to 10
xxxii	54	„	8 to 10
xxxvi	56	Food	10
xxxvi	57	„	10
ii	2	Water	11*
xxi	19	Milk	12
	60	?	13 to 14
xviii	25	?	14
xxxvi	58	Food	14
xxvi	38	?	15
xi	8	Milk	18
xxi	17	„	19 to 21
xi	7	„	22

Cases in which the exposure to a source of infection commenced at an undetermined date but ceased at a known date are of value in determining the maximum period of incubation. Among the cases collected by the Committee in very few belonging to this class did the interval between the cessation of exposure and the onset of symptoms exceed fourteen days. The milk epidemic described in Report xiv ceased within seventeen days of the stoppage of the presumed means of infection. In Cases 69 and 70 Dr. Murchison considered that the incubation period was twenty-one and twenty-two days respectively. In Case 15 the history points to an incubation period of not less than twenty-three days ; in several cases the interval between cessation of exposure to infection was fourteen days exactly or approximately.

Cases in which exposure to infection commenced at a known date, and continued thereafter for several days, are of value in showing the minimum period of incubation; that is to say, they may afford evidence as to a period of incubation shorter than the average, if the average period of incubation be taken as fourteen days. The following table contains the cases in which, if the evidence is accepted, the period of incubation must have been less than fourteen days; the facts do not of course show how much less the period was.

* Many cases.

Report	No.	Source of infection.	Incubation period may have been less, but cannot have been more than
xxv	25	Water	7
xv	10	Fomites	9
i	1	Water	10
xv	11	Fomites	10
xxx	47	Personal intercourse	10
xxx	48	,, ,,	10
xx	16	,, ,,	11
	68	,, ,,	11
xxx	49	,, ,,	12
xxx	50	,, ,,	12
xxxiii	55	,, ,,	12
xxv	—	Water	11 to 13*
xxi	21	Milk	13
xxx	51	Personal intercourse	13
	59	,, ,,	13

That the period of incubation does really vary in different individuals who may have contracted the infection from the same source seems to be fairly certain. Shortening of the period to less than that usually observed has been noted by the Inspectors of the Local Government Board, but generally in epidemics traced to milk. As an example may be quoted the following passage from Dr. Ballard's report on an outbreak of enteric fever at Armley.† He states that he found "that the largest consumers of the suspected milk were among the earliest, and the smallest consumers among the latest attacked." Notes on this point were made in 43 cases; in 19 of these cases it was specially mentioned that the suspected milk was very freely used as an article of diet, commonly at supper, either cold or boiled. All but four of these individuals applied for medical aid in the course of the first fortnight of the outbreak. In 24 cases very little milk was taken, and of these 17 sought medical aid in the course of the third and fourth weeks of the outbreak, and only 3 in the first, and 5 in the second week. Remarks by Mr. W. H. Power to a similar effect will be found quoted in Report xi at a later page; and the same distinguished officer of the Board, in a report on a localised outbreak of enteric fever at Norwood, in the Uxbridge R. S. D. (dated June 6, 1882), writes with reference to the incubation of certain cases, "Shortening

* 12 cases.

† *Reports of the Medical Officer of the Privy Council and Local Government Board*, New Series, No. 2, "Supplementary Report to the Local Government Board on some recent inquiries under the Public Health Act, 1885," London, 1874 [c. 1066].

of the incubation time may no doubt have occurred. It would be in accord with experience of certain milk outbreaks of enteric fever where consumers of large amounts of the implicated milk in a raw state have seemed to suffer fever within a very few days of their infective meal. And what is true of enteric fever conveyed by milk may be true also of enteric fever conveyed by water, for in both instances there is chance of infective matter of great potency getting applied directly and in abundance to the intestinal tract." Evidence which may be held to lend some support to this view is to be found in the limited epidemics described in Reports xxv and xxvii among others.

The opinions above quoted as to the shortening of the period of incubation in some cases in which the infection is derived from milk appear to refer to exceptional events. In a few of the cases recorded in the following pages the period has been less than the average—in one case (6), if the evidence can be accepted, as short as five days; but in the majority the history is compatible with a period of fourteen days or longer. The following is a summary of the facts as to the period of incubation in the milk epidemics :

Report	No.	
x ...	6 ...	Incubation period may have been 5 days.
xxi ...	18 ...	,, ,, must ,, 11 ,, at least.
xxi ...	19 ...	,, ,, was probably 12 ,,
xxi ...	21 ...	,, ,, may have been 13 ,,
xii ...	9 ...	,, ,, was probably 14 ,,
xxviii ...	— ...	The epidemic ceased a fortnight after the closure of the dairy.
xxi ...	22 ...	Incubation period may have been 15 days.
xxi ...	23 ...	,, ,, ,, ,,
xiv ...	— ...	The epidemic had ceased 17 days after the pump-handle was chained.
xi ...	8 ...	Incubation period was probably 18 days.
xxi ...	17 ...	,, ,, must have been 19 ,, at least.
xi ...	7 ...	,, ,, was probably 22 ,,
xxi ...	20 ...	Definite symptoms occurred 22 days after commencing to take the milk.

Duration of Infectious Period.

The number of cases which afford evidence as to the length of time during which a patient who is suffering or has suffered from enteric fever remains capable of communicating the disease is small; it may, however, be useful to

direct attention to those which do supply evidence on this point.

The incidents recorded in the Report by Dr. Parsons, here numbered xxx, leave little doubt that the disease was contracted from a patient in an early stage; the young man who was the first sufferer presented the early symptoms of the disease when he first came into relation with the persons who nursed him, and the first cases occurred among them ten days later; there is, therefore, a strong presumption that these persons contracted the disease on the first day they came in contact with the young man, and while he was suffering from the early symptoms. In two other cases, however, in which the circumstances were very similar (*see* Report xvii), the interval between the commencement of exposure and the onset of symptoms was considerably longer—at least three weeks. In the case mentioned in Report xxxi the wife of a man, who contracted the disease while at work, sickened a fortnight after her husband; the inference appears to be permissible that she took the disease from him while he was in a very early stage.

In some of the reports relating to epidemics in which the infection was distributed by drinking-water there is presumptive evidence that the infective material was derived from patients in an early stage. The small epidemic recorded in Report iv commenced within about seventeen days of the first occurrence of symptoms in the woman by whom the well is believed to have been specifically polluted. In the very similar incident contained in Report v the epidemic began within about fourteen days after the onset of symptoms in the first case. The occurrence related in the second paragraph of Report xiii also appears to afford evidence of contamination of well water by the excreta of a patient in an early stage; the value of the evidence, however, depends upon the degree of reliance which can be placed upon the disinfection of the soiled linen which is stated to have been practised after the first few days. In the well-known Caterham epidemic investigated by Dr. Thorne-Thorne (Report xxiii) the workman who infected the water-supply probably contracted the disease on December 25–6, and began to have diarrhœa on January 5; the first case in the epidemic occurred fourteen days later. The epidemic was mild, and it would not be safe to attach much importance to the precise dates at which cases came under treatment; in fact, the cases appear to reach two maxima a week apart—on

January 25 and February 1; these days were Saturdays, and the great excess on them was probably due to their being half-holidays and the end of the working week. Broadly stated, the facts of the epidemic are as follows, and are not without value in the present connection :—The specific pollution was taking place during the two weeks ending January 11 and 18, but no cases occurred during these weeks; the specific pollution ceased on the following Monday, and the epidemic began on the preceding day. During this, the third week after the commencement of the contamination, 56 cases were recognised; during the next week, 122 cases; and during the next, the fifth after the commencement and the third after the cessation of the pollution, the cases fell to 94; in the next week they fell to 57, and thereafter declined very rapidly. There is considerable probability, therefore, that a larger number of persons were infected during the second week of the patient's illness than at an earlier date. This epidemic may be compared with that which occurred in 1883 at Hitchin, and was reported on by Mr. W. H. Power (Report xxix). In this instance the specific pollution occurred probably on a single day only, and the epidemic reached its maximum during the third week thereafter, but cases continued to occur during the next week. An epidemic at Ystalyfera (Report xxx), traced to the use of water from a particular cistern known to have been specifically contaminated, ceased, so far as regards its special incidence on houses supplied with water from this source, fourteen days after the closure of the cistern. In the Guildford epidemic contaminated water was delivered on a known day, and on that day only, and the first symptoms in "a great proportion of cases" probably occurred eleven days later, and only in a minority of cases at a still later date (Report ii).

Instances of infection derived in all probability from convalescent patients are afforded by cases recorded in Reports xx and xxxiv. In the former a servant-maid entered a house and began to wait upon a patient who had been for twelve days convalescing from enteric fever; eleven days later the maid began to have diarrhœa, and on her return home was the means of infecting three members of her own family. The fact that all the other inmates of the house in which the maid contracted the fever escaped, renders it highly probable that she derived her infection from the convalescent patient, with whom she was brought into very close contact. In the other instance a woman who took a convalescent child to her

own house began to suffer from the disease twelve days later; in this case measures of disinfection had been taken, but it is not known how far these were effectual as regards the clothes of the sufferer, and it must be noted that the house from which the child was brought had been infected for several months; it is therefore possible that the woman may have contracted the disease during a visit to it. In Case 59 a woman suffering from scarlet fever was admitted into a hospital which contained five patients convalescent from enteric fever, and was waited upon by the same nurses. While convalescent from this fever, thirteen days after her admission into the hospital she again began to suffer from pyrexia, which turned out to be due to the onset of enteric fever.

How long a source of water-supply once specifically polluted may retain the power of conveying infection must depend upon a great variety of circumstances, which cannot be discussed here; in the case of a public water-supply, and a large body of water, it would seem that the removal of the source of contamination is followed after an interval of two, three, or at longest four weeks by a cessation of the epidemic, or at least of attacks directly contracted from the water. The case is probably different in small wells; Reports xiii and xxii give the history of small epidemics which appear to be best explained by assuming that the infection remained for a prolonged period in some way associated with the well, but not necessarily in the water. As Mr. Spear has observed in a Report quoted below (xxxvi), "there is much ground for the belief that the typhoid contagion may lie dormant in the soil for prolonged periods, becoming again active during the heat of summer." A striking example of the retention of infection in clothing for a period of about two months is found in the instance of importation of the infection from Toronto to Oxfordshire given in Report xv. Another instance in which infection was presumably carried in clothes is contained in Report xxxiii.

Conclusions.

(1) The general conclusion to be drawn from all the facts is that the period of incubation in enteric fever varies within rather wide limits. The interval between exposure to infection and the development of distinct symptoms is probably most often twelve to fourteen days; it is not very infrequently

nine or ten days, occasionally eight, and possibly even less. According to Dr. Murchison, "it may not exceed one or two days," but no case of the kind has been reported to the Committee. In rare cases it is prolonged to fifteen, eighteen, or even twenty-three days. Dr. Murchison thought it "very doubtful if the incubation period ever much exceeds three weeks."

(2) A patient suffering from enteric fever is capable of conveying the infection to others throughout the whole course of the disease, from the date of the earliest symptoms of illness, until convalescence has been established for at least a fortnight.

(3) An epidemic due to milk contamination may be expected to cease at or about the end of the second week after the arrest of the contaminated supply; but an epidemic due to contamination of a public water-supply may not come to an end until the fourth week after the source of specific pollution has been removed. Where an epidemic can be traced to well water its duration may be very much more prolonged, and no general statement as to the probable date of its spontaneous termination can be made.

(4) Infection can be conveyed by fomites, and retained in them, probably for two months at least.

CASES

Communicated by Sir GEORGE BUCHANAN, M.D., F.R.S., late Medical Officer to the Local Government Board.

i. *Case* 1.

Report by Dr. R. THORNE-THORNE on an Epidemic at Terling, 1863.

Well water.—A certain well supplying a row of cottages was dry until November 26; on that day water was again found on it, and was used in one cottage (A) for drinking on November 26, but in the other cottages not until several days later, "because it was turbid." The first case in the row (*Case* 1) occurred in Cottage A on December 6, ten days after the water was first used.

ii. *Case* 2.

Report by Dr. G. BUCHANAN on Enteric Fever at Guildford, 1867.

Water-supply.—Water believed on good evidence to have been the vehicle of infection was delivered on August 17, and on that day only. The first case (*Case* 2) came under medical observation on August 28, and a very large number subsequently (150 in first ten days of September). "The first symptoms in a great proportion of cases" probably occurred "on or about August 28, or eleven days after the operation of the cause." "This limit was probably in certain cases really exceeded."

iii. *Case* 3.

Report by Mr. NETTEN RADCLIFFE on Enteric Fever at Ingham, 1869.

Well water.—The first case was a girl who was brought to Ingham on April 1 suffering from the fever. A certain well into which fever stools may have soaked was used by a man who was found to be suffering from fever on April 21.

iv.

Report by Dr. GWYNNE HARRIES on Enteric Fever at Burbage, 1871.

Well water.—A woman sickened May 20—25, and had opportunity of using a privy near a certain well. Drinkers of this well water alone suffered. Fourteen cases occurred among them in the seven or eight days or so before June 12.

v.

Report by Dr. R. THORNE-THORNE on Enteric Fever at Bishop's Stortford, 1873.

Well water.—A boy who attended a day school in another part of the town was attacked with enteric fever while living in a cottage, one of a row of five, each with a separate drained closet, but a well in common. The soil-pipe of the closet in the house in which the boy lived leaked, and the well was seven feet away. The disease in this locality appeared to be distributed through the drinking-water. "Within fourteen days of the commencement of 'the boy's' attack" enteric fever broke out in another cottage, and within three months all the cottages had been invaded.

vi.

Reports by Dr. G. Buchanan, Ecton, 1872, and Dr. R. Thorne-Thorne, Lewes, 1874.

Ten days to a fortnight was the interval between exposure to presumed cause and first manifestation of symptoms; "but the causes are not so limited or so defined as to give any particular value to the cases as proving an incubative period." (G. B.)

vii.

Report by Dr. Ballard on Enteric Fever at Bourton, 1874.

River water.—On May 10 a case contracted at Oxford occurred at a mill a mile up stream, where the privy overhung the stream. The first medical attendance on cases of fever at Bourton (all having drunk the water) were made on June 10, 12, 13, 14, 19. Before September 10 one in twelve of the population had suffered.

viii. *Case* 4.

Report by Dr. G. Buchanan on Enteric Fever at Croydon, 1875.

Pollution of domestic water-supply.—"At a school where foul air and other matters entering water-pipes is held to have been the mechanism of fever distribution, cases occurred before holidays and after holidays. The first case (*Case* 4) after holidays showed symptoms fourteen days after return of the pupil to the school." (G. B.)

ix. *Case* 5.

Report by Dr. Buchanan on Enteric Fever at Over Darwen.

Pollution of urban water-supply.—Contamination of water-supply by leakage of pipes. First case occurred about fourteen days after.

x. *Case* 6.

Report by Mr. Netten Radcliffe and Mr. W. H. Power on Enteric Fever in Marylebone, 1873.

Milk.—A child (*Case* 6) spent July 19 with a family supplied by a dairy which was believed to have distributed milk containing the specific infection. On July 24 this child was attacked by the fever. If the child contracted the disease on July 19 the period of incubation was only five days, a period shorter than in any other case. Of the family visited ten members were attacked between July 21 and August 1. "The facts concerning the differential distribution of ordinary and nursery milk in their relations to the distribution of fever could be explained if an incubative period of fourteen days more or less were granted." (G. B.)

xi. *Cases* 7 *and* 8.

Report by Mr. W. H. Power on Enteric Fever at Eagley, 1876.

Milk.—Mr. Power writes:—"Some facts of considerable pathological interest, as suggestive of inconstancy in the period of incubation of enteric fever, came under notice during the inquiry. It was observed that the interval elapsing between the last occasion upon which the milk

was taken and the beginning of illness was in several cases unusually protracted. In the following instances, causes of fever other than the milk could be almost absolutely excluded:—E. B., aged 14 (*Case* 7), one of a family not taking the particular milk, exceptionally partook of it on January 30; she was attacked on February 21. M. W., aged 15 (*Case* 8), a member of another family not taking the milk, partook of it not later than February 2 (the date of arrest of this milk-supply in Eagley); she, attacked not earlier than February 20, became definitely ill with fever, February 25. Other and similar instances might be mentioned. On the other hand, there was found reason for believing that in many instances fever followed very closely (in a few days) on the infective dose of milk, though upon this head the evidence was not completely demonstrative. It seems certain, however, that 'great milk drinkers' were proportionately early sufferers in the outbreak." Both the above cases, however, occurred during an extensive epidemic, and it was therefore difficult to exclude other sources of contagion.

xii. *Case* 9.

Report by Dr. R. Thorne-Thorne on Enteric Fever at Brierley Lane, 1874.

Milk.—A young woman, not shown to have otherwise had opportunity for infection, was in the habit of visiting a house where infected milk was used. Her last visit was paid a fortnight before she fell ill of the fever.

xiii.

Report by Dr. Ballard on Enteric Fever at Moseley and Balsall Heath, 1873.

Contamination of well water; distribution by milk.—Between November 24, 1872, and January 6, 1873, 96 cases occurred in 50 families, traced to milk in 47 families. The milk was supplied by a milk-seller, next door to whom lived a man who had diarrhœa on and after November 3, rigors November 17, and died November 23. This man's privy soaked into the milk-seller's well. Evidence showed that the milk was contaminated after reaching the milk-seller's house. In the last few days of November, and in the week ending December 7, 20 families were attacked; in the week ending December 14, 11; in the week ending December 21, 12; in the week ending December 28, 3; and 3 in the following week. The first cases occurred, therefore, a little more than three weeks after the commencement of the chance of specific pollution of the milk-seller's well.

Contamination of well water by washings of foul linen.—A laundress, living in a row of cottages a mile away in the country, received a parcel of foul, not disinfected linen on December 9, 1872, from a case not yet under treatment. The common well of the row had opportunities of receiving washings of the infected clothes. The first case occurred in the row (not in the laundress's house) on January 4. The clothes sent to the laundress after December 11 were treated with disinfectants.

xiv.

Report by Dr. Ballard on Enteric Fever at Armley, 1872.

Contamination of well water; distribution by milk.—The milkman took to his bed with enteric fever, probably contracted in another town, on May 17. Opportunity existed for the milkman's well water to become infected; this probably recurred during the week ending

June 8, owing to heavy rain which fell then. Two cases occurred in one family, supplied by this milk-seller, on June 20. Then an interval of ten days, and then a sudden outburst, namely, 12 new houses attacked between June 30 and July 6. In the week ending July 13, 11 fresh houses; in the week ending July 20, 10 fresh houses; and in the week ending July 27, 16 fresh houses were invaded. Thereafter a sudden diminution was noticeable in the number of houses attacked (in the week ending August 3 only 2). On July 10 the handle of the milkman's pump was chained up, and there was no suggestion of any other change in the circumstances to account for the sudden diminution in the number of houses invaded which was noticed two weeks later. Specific pollution ceased July 10. Epidemic ceased week ending July 27.

xv. *Cases* 10 *to* 12.

Report by Dr. THORNE-THORNE on Enteric Fever in an Oxfordshire Village.

Fomites; evidence as to persistence of infection (instance recorded by Dr. Gilbert Child).—The wife of a man residing in Toronto died in September, 1873, of enteric fever. He subsequently left America, taking with him in several boxes bedding, clothes, &c., soiled by his wife during her illness. He arrived at his home in an Oxfordshire village on November 20, 1873; his mother and brother resided at this house. On November 29, 1873, the brother (*Case* 10) was seized with an attack of enteric fever which proved fatal. The mother (*Case* 11) sickened of the same disease on the following day. The only other case in the neighbourhood was a woman (*Case* 12), a relation of the man from Toronto, who had taken to her home some of the dirty things to wash. She was attacked December 5.

xvi.

Report by Dr. THORNE-THORNE on Enteric Fever at Clayton West, 1874.

Fomites; sewer air.—A laundress first received the first patient's foul linen "about middle of May." On June 16 a person in each of two houses having closest drain relations with the laundress's house fell ill of the fever. Fresh cases occurred almost day by day on the same local sewer system, until, in mid-August, 15 out of 23 cottages had had inmates attacked. "Drains and not water appear to have been the way of diffusing the fever infection in this case."

xvii.

Report by Dr. WHITLEY (3rd Rep., M. O. P. C.) on Typhoid Fever at Kingston Deverell, 1860.

Infection of nurses.—A man recently arrived home came under treatment for enteric fever on September 1, and was nursed by his mother, who came for that purpose from the other side of the village. His mother required medical treatment for enteric fever on September 23, and two women living next door, who had helped to nurse the man, "contracted" the fever September 25 and 30.

A young man who sickened November 16 was removed to his mother's house November 18. He was also nursed by an aunt, who lived in an isolated house. Both mother and aunt were seized about December 10. A boy who lived in the aunt's house sickened January 5.

xviii. *Cases* 13 *and* 14.

Report by Dr. R. THORNE-THORNE on Typhoid Fever at Turvey, 1876.

Visit to infected village.—The first case in Turvey was a man (*Case* 13) who drove to a neighbouring village with the doctor who was attending cases of enteric fever there. The man had no communication with any person, and took no food in this village, but "within about fourteen days" of his drive he was taken ill of enteric fever.

Laundress.—The second case in Turvey was a woman (*Case* 14) who during the latter part of the man's illness washed some foul linen in his cottage. "Within fourteen days" she was taken ill with well-marked typhoid.

The third and last case was her son, who sickened within about a fortnight of his mother.

xix. *Case* 15.

Report by Dr. BALLARD on Enteric Fever in Wakefield Prison, 1875 (from Official Report supplemented by Notes given privately).

Sixty-nine persons among those within the precincts of the prison were attacked by a febrile disease, probably enteric fever. The cause of the fever existed within the prison (to what extent outside also could not be defined), and the means of distribution was probably drain air. Seven persons fell ill of the fever after their discharge from prison. One man (*Case* 15), admitted to the prison on November 12, 1874, was discharged from prison on January 10, 1875, and was then "well." He shivered and vomited on February 2, and died on February 14. If, as was thought probable, he contracted the fever in prison, the incubation period must have been prolonged—twenty-three days.

xx. *Case* 16.

Report by Dr. BALLARD on Enteric Fever at Cornbrooke, 1873.

Infected by convalescent.—M. T. (*Case* 16) went from home to service at Leamington on November 14. She had to wait on a patient who had fallen ill with enteric fever on October 16, and had begun to convalesce on November 2. She alone of the Leamington family got fever. She sickened with diarrhœa on November 25, eleven days after entering the house, and had rigors on December 2. She went home on December 8, and was convalescent on December 30. Her sister S. sickened February 10, her mother February 12, and her father March 12. Another sister, J., returned home on March 11, and sickened twenty days later (March 31).

xxi. *Cases* 17 *to* 23.

Dr. BALLARD's Report to the L. G. B. on an Unusual Prevalence of Enteric Fever at Ascot during a Period of 4½ Years, dated July 10, 1878.

Milk.—Previous to the middle of 1873, during a period of forty years at least, no similar epidemic had occurred; the principal medical practitioner stated that during his experience of forty years he had met with cases in his practice "now and then, but rarely." P., a boy aged 10 (*Case* 17), went to London on or soon after July 2, 1873, and stayed two days. He returned to his father's house at Ascot from

London, and was taken ill with enteric fever on July 23. There was an epidemic during the middle of 1873 in Marylebone, traced to the milk-supply of a particular dairy. P. is known to have partaken of milk from this dairy (see above, Report x).

Milk.—C., a boy aged 9 (*Case* 18), went from his home in London to Ascot on July 23. He was taken ill with (enteric) fever on August 3, eleven days after ceasing to take the specifically polluted milk. C. is known to have partaken of milk from the above-mentioned dairy.

Milk.—A housemaid (*Case* 19) at a house in Ascot, about half a mile from the house in which C. resided, went to London on July 29, stopped the night at Fulham, visited a friend residing "within the Marylebone epidemic district, and returned to Ascot the next day. She was taken ill on August 10." (Twelve days.)

Milk.—On January 18, 1875, five children went to a house at Ascot, and at first used milk from cows kept for the supply of the family. On February 23, this supply failing, milk was obtained from a dairy farm ("B. K. F."). The milk from this farm was "the chief agent in the distribution of the fever" among families in Ascot. On and after February 28 all the milk for the household was derived from this farm. The children returned to London on March 16, and on March 17 one of them (*Case* 20), who had been ailing for more than a week, was attacked with enteric fever.

Milk.—Three children were taken to Ascot on April 10, 1877, From May 7 to 28 the children (and the children only) were supplied with milk from the farm "B. K. F." On May 20 one of the children (*Case* 21) was "attacked with enteric fever," and the other two (*Cases* 22 and 23) "were attacked" on May 22. Other persons in the house, and other families using milk from the same source as that given to the children before May 7, did not have the disease.

xxii. *Case* 24.

Dr. Ballard's Report to the L. G. B. on an Outbreak of Enteric Fever at Tolearne Head, New Quay, Cornwall, dated February 24, 1880.

Persistence of infection in well water.—The first case in the epidemic (of 1879) was a lady visitor who arrived January 11, and had fever when first seen by the medical man (Mr. Boyle) on January 13; she passed through a typical attack. On February 22 the wife of the hotel keeper who had visited the house in which the visitor was ill during her illness was first seen by the medical man; she had "simple fever," probably ambulant enteric. On May 10 the Rev. Mr. E., his wife, four girls, aged respectively 6, 7, 11, and 13, and three women-servants, came to reside at a house opposite the hotel and having a w. c. draining into the same imperfectly ventilated cess-pit. The water-supply was from the hotel well, close to which was a leaking drain. On May 26 or 27 (sixteen or seventeen days after coming to the house) Mrs. E. was taken seriously ill with rigors; she was ill for three weeks, but had no diarrhœa. Mr. Boyle considered her disease to be unquestionably enteric fever, but she kept up in order to look after her child J. E., aged 11, who on June 3 (twenty-four days after coming to the house) was found to be suffering from enteric fever; J. E. had diarrhœa, but no rose spots. On the same day, June 3, the child Margaret N., aged 6, was taken ill, and had an attack characterised both by diarrhœa and rose spots. Other cases of undoubted enteric fever subsequently occurred in the house. This

family came to New Quay from a Staffordshire village where fever was not existent.

At another house close to the hotel, draining into the same cess-pit, and in which the hotel water was used, cases of enteric fever occurred on July 11 and 14 and subsequently. Before these dates, viz. from June 30 to July 5, a Miss H. (*Case* 24) visited at this house; Miss H. from July 5 to July 16 stayed with a friend at Bristol, in whose house and immediate neighbourhood there had been no enteric fever. On July 16 she returned home to Esher, and on July 20, having been unwell for several days, she was first seen by a medical man, and subsequently passed through an unquestionable attack of enteric fever, with a little delirium and an exceedingly full eruption.

The infection in all these cases was most probably conveyed by the hotel water used for drinking.

xxiii.

Dr. Thorne-Thorne's Report to the L. G. B. on an Extensive Epidemic of Enteric Fever affecting especially Redhill . . . . and Caterham . . . . dated April 7, 1879.

Direct infection of water-supply.—The epidemic occurred among persons drinking the water of the Caterham Waterworks Company. During the latter part of 1878 and the beginning of 1879 a new adit was being constructed from one of the old wells to a new bore which was then being sunk. Work was suspended on December 14 and resumed on December 29. J. K., one of the men working in the adit, began to suffer from diarrhœa and other symptoms of enteric fever on or about January 5 (he had probably contracted the disease during a visit to Croydon on December 25–6).

The first case among the water consumers occurred on January 19, just fourteen days after J. K. had begun to be ill and to have diarrhœa; three persons were attacked next day, and by the end of the week 56 persons had been attacked. J. K. became too ill to work on January 21, and did not work after January 20. The number of cases in the week ending February 1 was 122; in the week ending February 8, 94; in the week ending February 15, 57; and in the week ending February 22, 18. After February 20 the epidemic, as confined to drinkers of Caterham water, was at an end, though a few scattered cases occurred in the district later.

The water was used in the Earlswood Asylum; the first case of enteric fever occurred there on January 28; on February 8 the use of the water was stopped, and no fresh case occurred after February 21.

xxiv.

Dr. Blaxall's Report to the L. G. B. on the Sanitary Condition of Certain Localities in the Blaby R. S. D. in connection with the Prevalences of Enteric Fever, dated July 21, 1881.

Well water.—On July 10 an outbreak of enteric fever occurred among the occupants of two isolated cottages about half a mile from the village of Whetstone. On July 22 one of the sufferers, a married woman, died, and her husband with four children "immediately left the house and went to stay with" Mrs. C., living in Kenny's Yard at the entrance to the village. One of the children was at the time suffering from enteric fever, and a second child was attacked two or

three days afterwards. The pump-well which supplied the drinking-water was within six or seven feet of Mrs. C.'s front door, and it was in evidence that waste water was habitually emptied on the surface over this well, there to run or soak away. There was no doubt that the water, in which the linen soiled by these children was washed, went along with other waste water. About three weeks after the arrival of the infected family at Mrs. C.'s an outbreak of fever occurred amongst the residents in Kenny's Yard, who all used Mrs. C.'s well; thirteen families out of nineteen were invaded between August 12 and September 30.

XXV. *Cases* 25 *to* 37.

Mr. W. H. Power's Report to the L. G. B. on a Localised Outbreak of Enteric Fever at Norwood, in the Uxbridge R. S. D., dated June 6, 1882.

Well water.—The outbreak was limited to the inhabitants of a portion of a terrace, and there was strong circumstantial evidence that the disease was communicated by drinking the water of a certain well. This well was exposed to the chance of specific pollution on and after November 27; there was "the usual difficulty in exactly fixing the date of attack," but Mr. Power by personal inquiry, case by case, ascertained that the early attacks occurred as follows:

1 case (*Case* 25) doubtfully on or about December 4, seven days after commencement of specific pollution of water.
12 cases (*Cases* 26 to 37) in the three days, December 8 to 10, eleven to thirteen days after commencement of specific pollution of water.
5 cases in the three days, December 11 to 13, fourteen to sixteen days after commencement of specific pollution of water.

XXVI. *Cases* 38 *to* 40.

Dr. Blaxall's Report to the L. G. B. on a Limited Outbreak of Enteric Fever at Sherborne, dated May 16, 1882.

Short exposure; contamination of water by sewer air.—A young gentleman (*Case* 38), one of a family of eight residing in Sherborne, left home on January 19, 1882, for one night, returning on the following day, January 20. Fifteen days afterwards he complained of feeling unwell (February 4), and was first seen by a medical man on February 11. "No other case occurred in this house or locality, and there can be little doubt the fever was contracted the night he slept from home."

There had been two other cases, however, in other parts of the town, commencing about December 9 and December 24 respectively. Evacuations or linen-washings from these two cases went into a sewer which was badly ventilated and liable to accumulations of filth. On February 21, after a long spell of dry weather (January and February), this sewer was flushed by damming the sewer at various places, so that it filled with liquid, which was then rapidly discharged. By this operation foul air would be driven out at any weak traps or available openings. The water in the cisterns in one house (H. M.'s) was exposed to sewer air from this sewer, both from a closet pan and a sink. In another house (A.'s) the pipes conveying the drinking-water "were in direct relation with the closet pans." There was strong circumstantial evidence that a series of cases of enteric fever in these houses were due to drinking the water, and that its specific pollution occurred within the houses.

The first case (*Case* 39) in A.'s house occurred on March 7 (fourteen days after the flushing of the sewer), the second on March 21—fourteen days after the first case. The first case (*Case* 40) in H. M.'s house occurred on March 7—fourteen days after the flushing. Subsequent cases occurred, two on March 14, and one on April 1, 5, and 7, respectively.

xxvii. *Cases* 41 *to* 46.

Dr. Blaxall's Report to the L. G. B. on an Outbreak of Typhoid Fever in two Families within a Fortnight of their leaving a Lodging-house at Weston, &c., dated June 21, 1883.

Well water.—The family B. had lodgings at No. 4, X Buildings, from the end of June to the beginning of August. The tenancy began on June 27, but the members of the party arrived at different dates; the latest arrival was Mr. H. B. The whole party, numbering six persons, left on August 8, and within fifteen days five of these persons were attacked with typhoid. One daughter, who left on July 29, escaped the disease. The infection was with a high degree of probability attributed to the drinking of water from a polluted well. The escape of Miss B., who left on July 29, renders it probable that the specific pollution, the source of which was not traced, occurred after that date. Mrs. B., who escaped the typhoid, lived in the lodgings from June 27 to August 8. During this period she had facial erysipelas, and several of the young ladies suffered from diarrhœa. The whole party returned home to Bath on August 8. The sanitary arrangements of this house were good, and there were no fever cases in the city at or about that time. On August 12 Mr. and Mrs. B., and a Miss P. who had been with them at Weston, went to Malvern, and on the same day a son and daughter went to Bwlch Tremyn, near Abergavenny. The following table gives dates of moving and of attack:

Case.	Initials.	Date of arrival at Weston.	Date of departure from Weston.	Place and date of attack.	No. of days after leaving Weston.
—	Miss B.	June 27	July 29	Escaped	—
—	Mrs. B.	„	Aug. 8	„	—
41	Miss A. B.	„	„	Bath, Aug. 17	9
42	Miss P.	July 3	„	Malvern, Aug. 19	11
43	Mr. B.	July 7	„	„ Aug. 23	15
44	Miss E. B.	July 28	„	Bwlch, Aug. 20	12
45	Mr. H. B.	Aug. 1	„	„ Aug. 23	15

Another family, consisting of eleven people, went to Weston on July 20, and left August 10. Three of the children subsequently suffered from continued fever characterised by diarrhœa, and in all probability typhoid. A little girl (*Case* 46) sickened August 23, and died December 2. Two little boys were ill on August 27, but eventually recovered without definite symptoms of typhoid.

xxviii.

Dr. F. W. Barry's Report to the L. G. B. on the General Sanitary Condition of the Borough of Gateshead, &c., dated June 11, 1884.

Infection in dairy.—Appendix B to this report contains a report by Dr. Charles Green, Medical Officer of Health, on an outbreak of enteric fever in Gateshead in February and March, 1883. The infection was clearly traced to the milk distributed from a particular dairy. A child of the dairyman had enteric fever, and was nursed by its mother, who also milked the cows and washed the milk-vessels. The dairy was closed on February 27. "Cases continued to occur for about a fortnight, and then ceased."

xxix.

Mr. W. H. Power's Report to the L. G. B. on Epidemic Prevalence of Enteric Fever in the Hitchin R. S. D., dated May 16, 1883.

Pollution of public water-supply.—An epidemic of enteric fever was found to be in all probability due to contamination of the public water-supply. The water was from a chalk well, but the receiving tank at the pumping station was liable to pollution by the back-flow (through an overflow pipe) of the water of the Hiz ("hardly better than a ditch a few feet in width") when this river was in flood. There were two outbreaks during the epidemic, one in mid-December, as to which nothing was discovered; the other in mid-January. On December 30 there was a heavy rainfall, and the water in the reservoir and delivered in the mains was turbid, owing to contamination by back-flow from the Hiz in flood. Mr. Power gives the following table, which also serves as a chart of the cases of enteric fever which subsequently occurred; the dates are the dates of invasion:

Week ending Jan. 6th.	Week ending Jan. 13th.	Week ending Jan. 20th.	Week ending Jan 27th.	Week ending Feb. 3rd.
1st Jan.	8th Jan.	14th Jan.	22nd Jan.	30th Jan.
,,	,,	,,	23rd Jan.	1st Feb.
Early Jan.	9th Jan.	15th Jan.	25th Jan.	,,
,,	10th Jan.	,,	26th Jan.	
	,,	Mid-Jan.	27th Jan.	
	,,	16th Jan.	,,	
	11th Jan.	,,		
	12th Jan.	,,		
	,,	,,		
		17th Jan.		
		,,		
		20th Jan.		
		,,		

The defect which permitted the contamination was remedied on January 13. The cases in the week ending January 16 belonged probably to the outbreak which began in mid-December, but the later cases may be attributed to the occurrence of pollution on December

30. The table is given, as it appears to afford a good example of the reaction, so to speak, of a population to specific pollution of its water-supply. The maximum is reached during the third week after the source of contamination is removed, and a rapid decline then takes place.

xxx. *Cases* 47 *to* 52.

Dr. H. F. Parsons' Report to the L. G. B. on the Prevalence of Enteric Fever in the Pontardawe R. S. D., &c., dated September 28, 1880.

Infection of nurses.—A young man, E. G., returned home from a distance to Mawe Llanguicke on or about September 4, suffering from the early symptoms of enteric fever. He was visited and nursed by relations and friends, of whom six took the disease, the dates of their commencing to be ill being two on September 14 (*Cases* 47 and 48), two on September 16 (*Cases* 49 and 50), one on September 17 (*Case* 51), and one on September 26 (*Case* 52).

Cistern water.—At Ystalyfera a severe outbreak occurred among people using water from a particular cistern, which had become specifically polluted. The suspected cistern was closed on September 26, and after October 10 the outbreak ceased so far as regards its especial incidence upon the houses supplied with water from this source.

xxxi.

Dr. Page's Report to the L. G. B. on at Outbreak of Enteric Fever in Beverley in 1884, dated January 16, 1885.

Infection in early stage.—Outbreak attributed to specific pollution of a certain water-supply. A railway labourer drank this water while at work only. He sickened on July 1, his wife a fortnight later.

xxxii. *Cases* 53 *and* 54.

Dr. Parsons' Report to the L. G. B. on the Recent Epidemic of Enteric Fever in the Borough of Kidderminster, dated January 13, 1885.

Polluted river water.—Falling Sands consists of three cottages and a forge or rolling mill, situated on the river Stour, one mile below Kidderminster, in a low damp situation. At a time when enteric fever prevailed in Kidderminster the whole of the sewage of that town was, owing to an accident at the sewage works, pumped into the Stour for three days, October 13, 14, and 15. On October 23, ten days after commencement of assumed specific pollution of the Stour, two sisters (*Cases* 53, 54) living in one of the cottages at Falling Sands sickened with enteric fever, one at Shrewsbury,* the other at home; the water-supply of the cottage was from a shallow dipping-place within a few yards of the river; the water was evidently only soakage from the river, the level at the two places rising and falling together. The fever may therefore, in Dr. Parsons' opinion, have been contracted by drinking specifically polluted water from the dipping well, or by "inhalation of fever germs in the spray of the sewage-polluted river water." The period of incubation of enteric fever is, he adds, "usually

* She had left home on October 23, and began to feel ill shortly after her arrival at Shrewsbury.

ten or twelve days, sometimes less." A third sister sickened on November 4, twelve days after her sister began. The theory that the infection in these cases was in some way due to the specific pollution of the river is thought to be confirmed by the fact that three young men (out of a total of twenty-five) working in the forge sickened with enteric fever on November 3, 5, and 6. They lived in separate cottages in a neighbouring hamlet; in one of these a previous case of enteric fever had occurred. Some of the men in the forge drank water from the dipping well unboiled, but whether the three who had enteric fever did is not known. All the men were exposed to the spray of the river thrown up by the water-wheel.

xxxiii.

Mr. W. Harvey's Report to the L. G. B. on the Recent Disease Prevalent in . . . . the Holyhead R. S. D. . . . 1886, unpublished.

Fomites.—J. sickened with enteric fever on June 26—28. His mother left her home and returned (date not stated) to her father's house in order to avoid being confined in her own fever-stricken house. This woman's sister sickened with (mild) enteric fever September 18, and Mr. Harvey considers that her illness "resulted irom the infective material being conveyed either on her (J.'s mother's) person or in her bundle." The district was a thinly peopled agricultural area.

xxxiv. *Case* 55.

Mr. Spear's Report to the L. G. B. on an Outbreak of Enteric Fever in the Wrexham R. S. D., 1887.

Personal intercourse with convalescent.—On October 4 a house having nine inmates, among whom eight cases of enteric fever had occurred since the end of July, was cleared, and the sick removed to the hospital. A woman (*Case* 55) living in one of two isolated cottages took two of the children from this house, viz. a convalescent and the baby, who had not had the fever. On October 16 the woman began to show symptoms of fever.

xxxv.

Dr. Parsons' Report to the L. G. B. on a Recent Outbreak of Enteric Fever in the Borough of Buckingham, June 8, 1888.

Variation in severity of cases attributed to variation in mode of infection.—A certain group of cases occurring early in the epidemic were due to pollution of drinking-water; leaky water-pipes laid in sewage-sodden ground. The outbreak occurred in January and February, 1888. The amount of sewage entering the water-pipe must have been small, and must have been going on for a considerable time, "but escaped notice until the sewage happened to become infected with the fever poison, and then an extensive outbreak of fever among the drinkers of the water was the result. Hence in my opinion this outbreak is to be classed with those which have been recorded, *e. g.* at Caterham ('Ann. Rep. of Med. Off. to L. G. B., 1879) and Bangor (ibid., 1882), resulting from the entrance of a relatively minute quantity of the specific fever poison into a water of pure origin." By the testimony of all the medical men in Buckingham the cases of fever belonging to this early group were much milder than those (subsequently originating) in the rest of the borough. The later cases were attributed to sewer air or personal

intercourse. The earlier group (traced to drinking-water) numbered 88 cases with only one death; in the later group there were 26 cases with four deaths. The mildness in the early group may have been in part due to many of the patients having been children, "but perhaps also to the mode in which the disease was contracted." This opinion is supported by Dr. Thorne-Thorne's observation that "by far the majority of the cases" in the Caterham outbreak "were of an exceptionally mild character." (See above, No. xxiii.)

Personal intercourse.—"The frequent instances of multiple cases in one family, as well as instances in which the disease appeared to be contracted in visiting or attending to the sick (though the influence of unsanitary conditions cannot be wholly excluded), point to the disease being directly communicable from person to person under the actual sanitary circumstances of Buckingham."

xxxvi. *Cases* 56 *to* 58.

Mr. Spear's Report to the L. G. B. on an Outbreak of Enteric Fever in the Pemberton U. S. D., Lancashire, May 7, 1890.

Presumed persistence of infection in soil.—The first case in Lamberhead Green, to which village the epidemic prevalence was confined, occurred on July 11. "The sufferer lived in a house exposed to emanations from foul midden privies, into which typhoid discharges had been thrown at the time of a localised outbreak of enteric fever a year previous. There is much ground for belief that the typhoid contagion may lie dormant in the soil for prolonged periods, becoming again active during the heat of summer."

Contamination of food by air (?).—The epidemic was characterised by a moderate prevalence amongst the general adult population, and special incidence within a limited period on children under sixteen years of age. Of the total number of 45 families invaded at Lamberhead Green, 32 occurred within the sixteen days, July 30 to August 14, and the first sufferer in 29 of the households, or 90 per cent., were children under sixteen years; of the 13 initial sufferers in the districts beyond that village only one was below sixteen years of age, and this was a boy who had visited Lamberhead Green a fortnight before his seizure. There was a fair at Lamberhead Green on July 22, and at one of the stalls was sold pease pudding and ginger beer, which had been made in the room where the first case (that of July 11) lay; the pudding and ginger beer had been kept overnight in a scullery adjoining, and ventilated from the sick chamber. It was positively ascertained that 14 of the earlier sufferers partook of the pease pudding and ginger beer; "there was reason to believe that the same held good as regards 9 others," and some probability that all the initial child-sufferers had partaken of these dainties, which were, at the close of the fair, given away to children. If the children were infected by food taken at the fair the period of incubation must have varied in different cases, for they came under treatment at various dates from eight to twenty-four days after the fair.

In the case of three patients residing beyond Lamberhead Green, the date of their visit to the infected village and of the first complaint of illness was ascertained. In two cases (*Cases* 56 and 57) the interval was ten days, and in one (*Case* 58) fourteen days.

Case 59.

Communicated by Dr. G. S. Middleton, Glasgow.

Infected by convalescent cases in hospital.—M. L., aged 26, a domestic servant, was admitted into an infectious hospital on December 27, 1877, at which time she was suffering from well-marked scarlet fever. She was placed in a separate room, but under the same roof as five patients convalescent from enteric fever, and was waited upon by the same nurses, but never directly came in contact with the enteric cases. Desquamation began on December 31, and the temperature fell on the same day. Nine days later, on January 9, when she was convalescent, though she had not got up, she had evening fever; thereafter diarrhœa, enteric temperature, &c.; the first enteric spots were seen on January 14. The interval between admission to the hospital and the beginning of the enteric pyrexia was exactly thirteen days. Her history before admission was carefully investigated with the assistance of her medical attendant, and it was "clearly shown that there was no reason to believe that the girl had had any chance of contracting enteric fever prior to her admission."

Case 60.

Communicated by Dr. J. B. Grewcock, Pershore.

A servant girl, A., on January 2 visited her sister's house in the village of Eckington, in which there was an epidemic of typhoid. On January 3 she returned to her place in another village a few miles away, where there was no typhoid. Her sister fell ill of typhoid fever on January 15 at Eckington, and A. on January 16 at the other village. The incubation period must have been thirteen or fourteen days.

Case 61.

Communicated by Dr. Philip Boobbyer.

Frank F., of Hucknall Torkard, was a regular visitor at a yard in East Kirkby (more than three miles away), where almost all the occupants were at this time down with enteric fever. He was there on November 19 and November 26, 1886. He left off work on account of enteric fever on December 6, seventeen and ten days after his latest visits. No other person in his vicinity at Hucknall was attacked.

Cases 62 *to* 66.

Infection conveyed by an infant.—Mrs. J. B. was taken ill with enteric fever on October 1, her baby, aged eight months, suckled up to that time, sickened with diarrhœa and restlessness on October 3. The baby was taken to Mrs. L.'s house, more than a mile away, on October 5; it continued to have diarrhœa and to be feverish for about ten days. Members of the L. family, all of whom nursed the baby "more or less," were taken ill (*i. e.* ceased to work or attend school) on the following dates:—(*Case* 62) Edward, aged 16; (*Case* 63) Mary, aged 14; (*Case* 64) Edith, aged 10, on October 28, 23 days after the baby had entered the house, and 13 after it ceased to have diarrhœa; (*Case* 65) Anthony, aged 13, on October 31, 26 days after the baby had entered the house, and 16 after it ceased to have diarrhœa; (*Case* 66) Frederick, aged 18, on November 4, 30 days after the baby had entered the house, and 20 after it ceased to have diarrhœa.

Case 67.

Communicated by Dr. BARNES, of Eye.

A lady was taken ill with the first symptoms of enteric fever after residing fourteen days in a locality where there had previously been no enteric fever. During these fourteen days two persons had been taken ill, the one with "gastric fever," the other with "typhoid fever" at the house, twenty miles away, from which she had come.

Cases 68, 69, 70.

The following cases were communicated to the Society by the late Dr. Murchison in 1878.

Mrs. L. (*Case* 68) went to Brighton to visit her brother, ill with enteric fever, on March 9, 1876. She returned to London on March 13. On March 20—eleven days after the commencement of her visit to her sick brother—she sickened with enteric fever.

On August 17, 1874, Miss B. (*Case* 69) left her home at Reigate for Scotland. On August 31 her brother, C., sickened with enteric fever at the house at Reigate, where there were local causes to account for the disease. Miss B. began to be ill with enteric fever, in Scotland, on September 7—twenty-one days after leaving Reigate. While in Scotland Miss B. had remained for a few days at Blairgowrie, where there were cases of enteric fever; the possibility of infection there cannot be excluded, but Dr. Murchison points out that the period of incubation, on the other alternative, is almost identical with that in the next case—her brother E. E. B. (*Case* 70) left the house at Reigate on September 15 with the other children, who had not been ill. It was stated that there was no enteric fever at the watering place (Eastbourne) to which they went, but E. B. fell ill there with enteric fever on October 7—twenty-two days after leaving Reigate.

INFLUENZA.

THE number of cases throwing light on the period of incubation in influenza which have been received is not large, but all agree in indicating a brief interval. Dr. Parsons, in his *Report on the Influenza Epidemic of* 1889—90, to the Local Government Board has supplied a considerable body of evidence, and it may be convenient to indicate his main conclusions here.

Taking first cases in which the disease followed after a single exposure to infection by personal contact with a patient already suffering, Dr. Parsons states that the usual interval was two or three days. The following cases of this kind received by the Committee point to a slightly longer interval as being more common :—

No. of case.		Interval.	No. of case.		Interval.
69	...	2 to 2½ days	7	...	4 days
1	...	3 „	8	...	4 „
3	...	3 „	11	...	4 „
5	...	3 „	34	...	4 „
68	...	3 „	4	...	5 „
70	...	3 „	9	...	5 „
75	...	3 „	10	...	5 „
22	...	3 to 4 „			

It will be observed that among these cases is no instance of the long periods, which have been supposed to be indicated by the interval noted on some occasions between the arrival of an infected person in a house and the next case. Influenza spreads in a community with great rapidity, and the slight nature of the symptoms in some cases leads sufferers to mingle with the general population in public places; it is, therefore, very difficult to exclude the possibility of any given patient having been exposed at a date subsequent to that assigned. The longer the supposed interval the greater the chance of such exposure.

In those instances in which a single member of a household has been exposed to infection while away from home,

and has subsequently developed influenza while at home, the interval between the onset of symptoms in this first case and the next case has varied from two to seven days. The Committee are indebted to Mr. Howard Murphy for a large number of cases of this kind, which have also been published by Dr. Parsons with some additional details. Altogether the following pages contain forty-two examples of this kind. The interval was 2 days in five cases; 2½ days in one case; 3 days in thirteen cases; 3½ days in two cases; 4 days in ten cases; 5 days in six cases; 6 days in two cases; and 7 days in three cases. Thus in twenty-five instances, or more than half, the interval was 3 or 4 days.

Dr. Parsons has published a table giving the experience of many Medical Officers of Health, and other medical men, as to the length of the period of incubation; the number who express an opinion that the period is generally either two or three days is greatly in excess of those who declare for a longer period. The number, however, who speak of having observed a period of only one day or less is considerable, periods of one day and of four days being mentioned with about equal frequency. It is worthy of note, also, that the number of supposed examples of incubation periods of seven days or more is considerably greater than the supposed examples of periods of five or six days. This suggests that in the instances in which longer periods are assigned, intermediate cases may have been overlooked. In other instances, the apparent prolongation of the period of incubation may have been due to the earliest case having been more or less effectually isolated during the first few days of acute illness; Case 71, among others, is probably an example of this. Both these sources of error are rather well illustrated by the small epidemic started by Case 74. Here the interval between the arrival of the gentleman who was considered with much probability to have imported the infection into a remote country village, and the outbreak among the villagers generally, was bridged by the circumstance that three and four days after his arrival, entertainments had been given to the villagers, at which both he and a case in the early stage were present.

Many other opinions might be quoted. It will suffice to indicate a few to which the attention of the Committee has been directed. Mr. Hewer, of Highbury, as the result of large experience, believes the incubation period to be "from two to three days." Dr. W. Tibbles, in his report on the epidemic of influenza in the rural sanitary district of Melton

Mowbray (*Brit. Med. Journ.*, 1890, vol. i, p. 835), expresses the opinion that "there is a period of incubation of about two days, often reduced to a few hours." Mr. Coventry Patmore, from his experience at Wormwood Scrubs Convict Prison, believes that there is an incubation period of "one to three days" (ibid., 1890, vol. i, p. 203). Dr. R. F. Quinton, writing also from prison experience (ibid., 1890, vol. i, p. 417), concludes that the period is "not more than two or three days." Dr. Stephen Mackenzie put the average period at four days (Medical Society, February 12, 1890); while Dr. Gilbart Smith on the same occasion spoke of one or two days, or a few hours only.

Four published instances of the outbreak of influenza on board ship have been quoted at the end of the list of cases communicated to the Committee, because they are probably free from some of the sources of error which attach to most cases occurring on shore. It will be seen that in the instance of the "Bretagne," the period of incubation in the first case was two days, and the epidemic outburst occurred on the next day, making it probable that the incubation period in these cases was three days. In the "Saint-Nazaire" and the "Serapis," the period appears to have been a little longer, but the facts are less conclusive.

Duration of the Period of Infectiousness.

It would seem probable that a patient suffering from the earliest symptoms of influenza is capable of giving the disease to susceptible persons. A good example is afforded by Case 68; confirmatory evidence will be found in the large number of instances in which the second case in a household followed the first after an interval of two or three days. That a convalescent patient may be a source of infection is shown by several cases; Cases 7, 8, 9, and 10, for example, probably derived the infection from children who had recovered sufficiently to go to a party; other similar cases are Nos. 11 and 30. Case 35 probably derived infection from a patient whose illness had commenced six days before the exposure, which determined the attack, began. In Case 31 the exposure began seven days after the infector was taken ill. Cases 38 and 39 are interesting because it seems probable that infection was conveyed ten days at least after the commencement of the attack, and that up to that time it had

been prevented from spreading by the patients keeping to their rooms.

Conclusions.

The general conclusions which appear warranted are—

1. That the incubation period varies from one day, or possibly a few hours less, to four or five days, but that the usual period is three or four days.

2. That a patient is capable of conveying infection throughout the whole course of the disease from the time of the onset of the earliest symptoms, and until convalescence has been sufficiently established to enable him to resume ordinary occupations, a week or ten days after the commencement of his illness.

CASES.

Cases 1 *to* 62.

Communicated by Dr. H. Howard Murphy.

Notes on epidemic at Twickenham, January and February, 1890. Dr. Murphy assumes that influenza appeared in London in December, and was prevalent by Christmas in an epidemic form. Most of the families had one or more members going to London daily on business. During the last week in December and the first week in January few people were affected, and it was "possible to decide without doubt the source and time of infection."

Mr. Q., who went to London daily, was ill with influenza on December 25; on December 31 Mrs. A. (*Case* 1) called and had a few minutes' conversation with Mr. Q. She was taken ill on January 3, 1890 (three days). The next case (*Case* 2) in Mrs. A.'s house occurred on January 6 (three days); three other cases occurred on January 8 (five or two days); other cases occurred on January 10 and 11. No second case occurred in Mr. Q.'s house until January 15.

On January 3 Miss M. (*Case* 3) had a few minutes' conversation at a party with a young lady who said she was suffering from influenza. Miss M. had a characteristic attack on January 6 (less than three days).

Mr. G., who went to London daily, was taken ill January 5. Mrs. N. (*Case* 4) visited him for a short time on January 5, and was taken ill January 10 (five days).

Miss R. (*Case* 5) saw a friend ill with influenza on January 12. She was attacked on January 15 (three days), and her sister (*Case* 6) (who had not been with her on January 12) was taken on January 18 (three days).

Mrs. H. and family lived a very retired life. On January 9 the governess took the four children to a party, also attended by some other children recently ill with influenza. The governess and one child (*Cases* 7 and 8) were ill on January 13 (four days), two other children (*Cases* 9 and 10) on January 14th (five days), and the fourth child on January 15.

On January 17 persons who had recently had influenza called on Mrs. B. (*Case* 11); she was taken ill on January 21, and Miss B. (*Case* 12), who had not seen the strangers on January 25.

Mrs. R. G., living in the north of London, went to Twickenham on a visit on December 17. She was taken ill with influenza on December 19, the first case in the neighbourhood known to Dr. Murphy. Mr. C. G. (*Case* 13) was taken ill on December 23 (four days). Other cases followed in this household on December 26, 31, and January 9.

C. J., a boy, stayed a few days in London with his father, who had had influenza on December 22. C. J. returned home to Twickenham ill on January 4. Other cases followed in the family, viz. the baby (*Case* 14) on January 8 (four days), Mrs. J. and a boy on January 12. Other cases followed on January 18, 22, and 25.

A boy, K., who had been staying for a few days with friends in London who had had influenza, returned to Twickenham on December 31, and was taken ill. Four of his brothers and sisters were taken ill on January 2 (*Cases* 15, 16, 17, 18) (two days), Mr. K. (*Case* 19) on

January 3 (three days), a child and two servants on January 5, and Mrs. K. on January 7.

Mr. H., who went to London daily, was taken ill on December 28; Mrs. H. and a servant (*Cases* 20 and 21) on January 2 (not more than five days).

Mr. O., who lived in a business house in London where many had been ill with influenza, was taken ill December 27, and returned home December 28. He went back to London next day. His sister (*Case* 22) was taken January 1 (not more than four nor less than three days). Other cases occurred in the same household on January 9, 13, 29, 30.

Mr. B., who went to London daily, came home ill on January 2. On January 9 Mrs. B. and her parents (*Cases* 23, 24, 25) were attacked (seven days after B.); a servant on January 8.

Mr. C., who went to London daily, was ill on January 4; Mrs. C. (*Case* 26) on January 8 (four days).

Mr. A., who went to London daily, was ill on December 21, the baby (*Case* 27) on December 24 (three days), a servant on January 4, and another child on January 25.

Mr. G., who went to London daily, was taken ill on December 29, Mrs. G. (*Case* 28) on January 1 (three days), Miss G., January 5 (four days after her mother), Miss M. G., January 18.

Mr. L., who went to London daily, was taken ill on January 6, a servant (*Case* 29) on January 9 (three days), Mrs. L. on January 16, two children on January 23, and one on January 27.

Mrs. L.'s governess was attacked on January 9, after visiting friends in London who had been ill. A child (*Case* 30) was attacked on January 12 (three days), Mrs. L. and another child on January 18, Mr. L. on January 19, and another child, who had been kept as separate as possible, on January 29.

Infection conveyed by patient seven days after attack.—Mr. L., who lives in London, was taken ill January 11; he went to stay with relations at Twickenham on January 18. One of them (*Case* 31) was attacked on January 21 (three days), and another (*Case* 32) on January 23 (not more than five days).

Mr. P. went to work daily in a neighbouring town. He was taken ill on January 8, his child (*Case* 33) on January 11 (three days), his wife on January 14 (three days after child), baby on January 25.

Mrs. W.'s serving maid (*Case* 34) went to see her mother ill with influenza in a neighbouring town on January 5, she was taken ill on January 9 (four days), was sent home on January 11, returned to her place January 15. Mr. W. (*Case* 35) was taken ill January 18, baby January 28, Mrs. W. February 1.

Mr. H. went to London daily, was taken ill on January 14, the baby (*Case* 36) on January 19 (five days), child on January 22, servant January 24, another child and another servant on January 25.

Miss D. B. while away from home on January 14 was taken ill, and returned home January 15. Mrs. B. (*Case* 37) was taken ill January 19. Both kept in their bedrooms for ten days, till January 29. A servant (*Case* 38) sickened February 3, and the charwoman (*Case* 39) who waited on her February 6.

Miss X. B., having influenza, went on January 18 to stay with Mrs. S. (*Case* 40), who had influenza on January 24 (not more than six days).

Mr. Z., residing in a business house in a neighbouring suburb, was

taken ill on December 30, and went to his home at Twickenham that evening. Mrs. Z. (*Case* 41) was taken ill January 3 (four days), a child on January 10, and another child on January 25 (from a different source of infection, according to the mother).

The disease appeared in the house of business mentioned in the above paragraph under the following circumstances: the health of all in the house was good when on December 21 Mr. V. went to visit some friends in London; he returned on December 23, and was taken ill on December 24. The next case (*Case* 43) occurred in the house three days later on December 27, and, three days later again, six cases (*Cases* 45, 46, 47, 48, 49, 50) occurred on December 30.

Mrs. W.'s child, who goes to school, was taken ill on December 28, and a younger child (*Case* 51) who was kept at home, on December 31 (three days).

Mrs. D., who may have been exposed to infection while shopping, was taken ill on January 2, her daughter (*Case* 52) on January 5 (three days), and Mr. D. (*Case* 53) on January 6 (four days).

Second attack after forty-three years.—Mrs. L. (*Case* 54), aged 80, had influenza badly in 1847. On January 6, 1890, she had similar but much milder symptoms. Miss L. (*Case* 55) was attacked January 10 (four days), a servant on January 17.

Mrs. B., who may have been exposed while at work, was taken ill January 9, and her child (*Case* 56) January 11.

Mrs. Fa., who thought "she got it shopping," was taken ill January 10, a child (*Case* 57) on January 14 (four days), another on January 27.

Mrs. Fb. was taken ill January 22, a child (*Case* 58) on January 26 (4 days), another (*Case* 59) on January 27, and a third (*Case* 60) on January 28.

Mrs. M.'s child was taken ill January 23, and the baby (*Case* 61), who was kept at home, on January 28 (five days).

The writer considers—

(*a*) That the usual period of incubation is probably about seventy-two hours.

(*b*) That the period of infectiousness begins with the initial symptoms, and lasts at least eight days.

(*c*) That the contagium is probably conveyed in the breath, since there is no rash or desquamation.

(*d*) That the contagium does not travel far, since in households in which the sick kept their rooms no fresh cases occurred until they got about the house again.

(*e*) That isolation of the sick and the use of disinfectants (carbolic baths, sheets, spray, &c.) were effectual in preventing its spread in every case in which he resorted to these means.

(*f*) That no evidence could be obtained pointing to infection by clothes, letters, furniture, milk, or water.

Cases 62 *to* 67.

Communicated by Dr. J. H. Wilson, Kenninghall, Thetford.

The only three houses in which Dr. Wilson knew influenza to be in his neighbourhood on January 13, 1890, were those in which the head of the family had just returned from London. (*a*) E. S. G. (*Case* 62) spent three days in London while in good health, and returned on Saturday evening, January 4. The next evening, January 5, he began

to be ill with influenza. On January 7, in the morning (2½ days), one of his boys (*Case* 63) sickened, and by January 8 in the morning two more boys (*Cases* 64, 65) were ill. On January 10 two more children were taken ill suddenly; on January 11 one more; on January 12 another; two others—nine in all—were affected before January 13. (*b*) In the second household the head of the family (*Case* 66) exhibited initial symptoms of influenza twenty-four hours after his return from London, and four other members of the family suffered soon after. (*c*) In the third household (different parish) the father (*Case* 67) also exhibited the initial symptoms twenty-four hours after his return from London.

Case 68.

Communicated by Dr. Edward Casey, Windsor.

Infection conveyed during initial symptoms.—C. (*Case* 68), residing in a sequestered country parish, was visited on January 1st by B., who dined with him. B. had come from a house at a distance in which influenza was present, and was already showing the early symptoms of what proved to be a sharp attack. On January 4 C. had some sore throat, on January 5 felt very tired, on January 6 felt "bad," and on January 7 suffered chills, headache, &c., followed by an ordinary attack (sore throat three days, and chills six days after B.'s visit). No other case occurred in the village until a fortnight later.

Case 69.

Communicated by Dr. C. J. Cullingworth, London.

A young lady (*Case* 69) came to London to stay with friends at Christmas. She met a brother living in London on January 3 (and probably on previous occasions), and not again until January 7. On January 6 this brother had well-marked symptoms of epidemic influenza, but the next day he was well enough to meet his sister and accompany her to Kensington Museum. They were together from 6.30 to 9.30 p.m., and on parting kissed. About 5 p.m. on January 8 the sister began to feel chilly and ill, and January 9 she had undoubted influenza. The only other known communication with previous cases was—(1) At noon on January 6 she received, opened, and read a letter from a lady who had recently had influenza. (2) At 11 a.m. on January 7 she went to a house in which were at that time several cases of influenza.

Case 70.

Communicated by Dr. Jas. E. Sinclair, Storey's Gate, London.

The first cases of the general outbreak were observed by Dr. Sinclair in his practice on and after December 13, but his child's nurse (*Case* 70) was taken ill with well-marked typical influenza on December 3; she was convalescent on the fifth day, but had a relapse on December 20. The child slept in the same room, except from December 3 to December 8; it did not develop the disease. The nurse had had no communication by letter with any country affected with the epidemic; she knew no one ailing in London; except to church, she was never out of the house except with the child; but on November 30 (three days before the initial symptoms in the nurse) a lady called at

Dr. Sinclair's house and went into the nursery. This lady "had just come from Paris, leaving her household there ill with 'la grippe.' This lady returned home, and was ill herself in Paris of the epidemic on December 24th." Dr. Sinclair considers that the nurse must have acquired the disease either from animals out walking, or from this third party who had not then had the disease.

Cases 71 *to* 73.

Communicated by Dr. WILLIAM SQUIRE.

A girl aged 17, residing at South Kensington, was seized suddenly on December 14, 1889. She was in bed for two days, and on December 17 and 18, during which days she was still confined to her room, her brother, M., aged 14 (*Case* 71), was much with her. He was seized suddenly on December 19, two days after coming into intimate relations with his sister.

A lady aged 22, residing at Ealing, was seized suddenly on December 29, 1889, the day after going to London. This was the first case in the house. On December 27 another lady, A. (*Case* 72), arrived in the house on a visit from the north of London. A. was attacked suddenly on December 31. The incubation period may have been two or four days. Her sister, who was much with her on January 1 and 2, was taken ill on the night of January 2.

A lad (*Case* 73), aged 15, came to London in good health on January 4, 1890, from a house in which there had been no cases of influenza. He was seized with influenza on the following day, January 5.

Case 74.

Communicated by Dr. DAWSON WILLIAMS.

On a Thursday and Friday some amateur theatricals were given in an isolated country village in which no cases of influenza had previously occurred. On the Sunday and Monday numerous cases occurred in the village, especially among children who had attended the theatricals. On the previous Monday a gentleman (*Case* 74) suffering from influenza had arrived from London, stayed at a house just outside the village, and attended the theatricals. On the Friday his hostess, who acted as prompter, felt ill while engaged in that capacity, and had a well-marked attack on the following day.

Case 75.

Communicated by Mr. W. J. TOWNSEND BARKER, Churchingford, near Honiton.*

Mr. X. (*Case* 75), aged 47, subject to bronchitis and laryngitis, went to Paris on December 18, 1889, stayed that night in an hotel where there were several cases of "la grippe," and returned home on December 19. He was taken ill on December 22 (three days) and had an attack of influenza of catarrhal type. This was the first case in the neighbourhood, and the six cases which alone followed had all been in

* Reported also in *Brit. Med Journ.*, 1890, i, p. 202.

relation with Mr. X., viz. a daughter taken ill on January 2, a son on January 5, two daughters on January 7, a daughter on January 10, and Dr. Townsend Barker on January 11.

Epidemics on Shipboard.

An outbreak of influenza on board the industrial training ship "Mount Edgcumbe" (Saltash, Cornwall).* The first case occurred on January 31st, 1890. On February 2 there were six fresh outbreaks; on February 3, eight fresh cases; and on February 4, 5, and 6, on each day sixteen fresh cases; thereafter a smaller number, the last case being on February 11.

"Serapis" (troop-ship), quoted by Dr. Parsons. On passage to Bombay. The first case was an officer who visited some friends at Malta (who had been suffering from the disease) on December 26, 1889, he being attacked on December 31. The next case was on January 1, when near Suez. Ship left Portsmouth on December 18.

At the meeting of the Académie de Médicine on February 4, 1890,† Dr. Proust reported the following instance communicated to him by Dr. d'Hoste of the steamship "Saint Germain." This boat left Saint-Nazaire on December 2, it was at Pauillac December 3 and 4, and on December 5 it called at Santander, where it embarked a passenger coming from Madrid; the health of the ship was excellent, but on the day after his embarkation this passenger was seized with influenza. Four days later (December 10) Dr. d'Hoste was seized with influenza, then two days after him an attendant, and then the epidemic became general, affecting altogether 154 passengers out of 436, and 47 sailors.

M. Danguy des Déserts,‡ médicin-major de la Bretagne, states that the training ship "Bretagne" moored in the roads at Brest had a complement of 850 men, of whom 244 were attacked by influenza during the second half of December, 1889. On December 11 an officer received from Paris, where influenza was then prevalent, two large trunks containing boxes packed in wood shavings; he unpacked them himself, and three days afterwards he was attacked with influenza; on the next day and the day after his wife and three servants were attacked. On December 14 this officer went on board the "Bretagne" and remained twenty-four hours; the second case on board the vessel was an adjutant attacked on December 16, and the epidemic broke out on December 17, from 20 to 45 men sickening by day. In every case in which an officer was allowed to go ashore to be treated at home the disease subsequently broke out in his family. Up to the end of December the number of cases in the town of Brest had been small, and up to the same period no cases had occurred on board two other training ships, the "Borda" and the "Austerlitz," which were moored alongside the "Bretagne."

* Dr. George Preston, *Brit. Med. Journ.*, 1890, i, p. 477.
† *Bulletin*, xxiii, p. 170.
‡ *Semaine Médicale*, 1890, p. 5.

MEASLES.

THE late Dr. Murchison (*Transactions*, vol. xi, p. 241) expressed the opinion that the incubation period of measles, although subject to variations, is quite as definite as that of smallpox. The discrepancy in the statements made in different works was, he maintained, due in a large measure to differences in the mode of calculating the period of incubation, which was frequently taken to end only at the time when the rash appeared, so that the stage of primary fever, which lasts three or four days, had been included in the period of incubation. Making allowance for this, he concluded that "the incubation period of measles is usually about ten or eleven days. It is worth noting, however," he continued, "that, just as in the case of smallpox, when the poison is introduced by inoculation, the incubation period is shorter, or only seven days.* . . . . The best observations on the incubation period of measles with which I am acquainted are those made by Panum in the epidemic which occurred in the Faroe Isles in 1846. There were seventeen of these islands inhabited. Prior to April 1846 not a single case of measles had been observed in these islands since 1781; but within six months more than 6000 of the 7782 inhabitants suffered from it. Panum was able to trace the importation of the disease from one island to another, and in this way he had an opportunity of determining the period of incubation in a very large number of instances under the most favorable circumstances. With

* He gives the following facts in a foot-note:—"Successful inoculation with the blood of measles was performed by Home, of Edinburgh, at the suggestion of Monro, in 1758; by Speranza, of Milan, in 1822; and by Michael, of Katona, in 1842. An account of Michael's experiments will be found in the *Gazette Médicale de Paris* for 1843. In all he made 1122 inoculations; only 7 per cent. failed. The disease was mild; not one of the inoculated died, although a severe epidemic was prevalent at the time. The primary fever appeared on the seventh day, and the eruption on the ninth or tenth day after inoculation. The inoculations were made with a mixture of blood and serum from the miliary vesicles, or with tears. More recently measles has been successfully inoculated by several German physicians, of whom Jörg and Wendt assert that the disease from inoculation is not less severe than that contracted in the ordinary way." Inoculation of the desquamating scales during convalescence has not produced the disease.

scarcely an exception *the eruption of measles appeared* on the thirteenth or fourteenth day after exposure to the infection. In other words, the incubation period was about ten days."

Duration of period of invasion.—The duration of the primary, prodromal, or catarrhal period is not constant; the general experience appears to be that it lasts, as a rule, for three or four days, but this period is often exceeded; in several of the cases communicated to the committee it was prolonged to five days. In Case 30, reported by Dr. J. W. Carr, there was a prodromal period of seven days, during which there was irregular pyrexia. Trousseau believed that it might endure for eight days, and Watson for ten. On the other hand, it may be considerably less than three days, as will appear from cases to be presently narrated, in some of which no symptoms were noticed until the day before the rash appeared. Dr. Squire observes that "the invasion stage of measles may be so brief as to escape notice;" and he quotes in support of this statement the case of a girl aged six years, who had the rash of measles "with no obvious evidence of previous sickness, not even for an hour."

Incubation Period.

In a large portion of the cases communicated to the committee it is necessary to take the day of the first appearance of the rash as the only available fixed date, since in many instances the date of the earliest symptoms was not known or is not stated.

The following list contains thirty-six instances in which the exposure was for a short known period; it will be seen that in nineteen, or 52 per cent., the subsequent interval before appearance of the rash was exactly fourteen days. In twenty-eight, or 78 per cent., the period was thirteen, fourteen, or fifteen days. In three cases only is the period believed to have exceeded fifteen days: in two (Cases 67 and 81) it would appear to have been sixteen days, and in one (Case 82) eighteen days; but it should be noted that in Cases 81 and 82, which occurred during an epidemic in a village, the source from which the first case, which is believed to have infected all the others, derived infection is not known. In four cases the interval between exposure to infection and the first appearance of the rash is stated to have been only ten days. In three of these cases the dates are not given, but in other respects the histories appear to be pretty conclusive; in the

fourth case the subject was a medical student, and the possibility of exposure to a case in the prodromal stage cannot be altogether set aside.

The true period of incubation—that is to say, the interval between exposure to infection and the onset of the earliest symptoms—is only shown in a few of the cases; it varied from eight to fourteen days, but was most often ten or eleven days.

TABLE I.—*Showing the interval, after a single exposure to a source of infection, at which the earliest symptoms (if stated) and the rash appeared.*

No. of case.	No. of days to first symptom.	No. of days to rash.	Remarks.
43	8	10	A medical student, examined several cases of measles.
63	—	10	Visited a case of measles.
64	—	10	Infector in catarrhal stage probably.
65	—	10	Ditto.
66	—	12	Infector "ill with measles."
68	—	13	Infector ill 2 days before rash.
69	—	13	Ditto.
114	10 or 11	14	Visited patient with rash full out.
5	11	14	Visited patient convalescent.
45	11	14	Visited patient 3 days before rash.
3	13	14	Visited patient convalescent.
37	—	14	Ditto.
38	—	14	Interview with patient day before rash.
39	—	14	Ditto.
46	—	14	Associated with patient for 19 hours preceding rash.
47	—	14	Ditto.
48	—	14	Ditto.
49	—	14	Ditto.
70	—	14	At school with patient 2 days before rash.
71	—	14	Ditto.
72	—	14	Ditto.
73	—	14	Ditto.
74	—	14	Ditto.
75	—	14	Ditto.
76	—	14	Ditto.
77	—	14	Ditto.
40	10	15	Interview with patient 2 days before rash.
41	10	15	Ditto.
42	10	15	Ditto.
78	—	15	At school with patient 2 days before rash.
79	—	15	Ditto.
80	—	15	Ditto.
115	14	15	Visited patient with rash full out.
67	—	16	Interview with patient 2 days before rash.
81	—	16	At school with patient 2 days before rash.
82	—	18	Ditto.

Something may be learned also from cases in which, though the exposure was prolonged, it began at a known period before the appearance of symptoms. Some of the cases afford evidence in favour of a short period which is, on the whole, very strong. They cannot, of course, give any facts as to unusually long periods, and it is therefore necessary to refer only to those which appear to indicate an unusually short period.

TABLE II.—*Showing cases in which exposure commenced at a known date.*

No. of case.	No. of days from commencement of exposure to first symptom.	No. of days from commencement of exposure to rash.	Remarks.
105	4	7	Continuous exposure.
62	—	7	Ditto.
96	—	11	Associated with convalescent.
30	5	12	Exposure ceased on appearance of rash; 10 days from rash to rash.
29	9	13	Exposure ceased on appearance of rash; 11 days from rash to rash.
32	9	12	Exposed in a cottage to patient with rash.
33	9	12	Ditto.
34	9	12	Ditto.
35	9	12	Ditto.
36	9	12	Ditto.

In all these cases, with one exception (Case 96), the patient was exposed for some time either immediately before the appearance of the rash, or during its height; and it may be that, as is probably the case with enteric fever (see p. 167), the period of incubation is really shortened when the "dose" of infection is large. Dr. Squire thinks that "a long interval may be looked for after a limited exposure, and that a continuous exposure tends to shorten the interval;" the cases in the above Table (II), also tend to support this view. In one, however, the infection was derived from a convalescent patient, and in two others the exposure ceased on the appearance of the rash, but there had been close relations during the primary stage. In Case 43 (see Table I) the infected person was a medical student who examined several cases of measles at a hospital, and therefore came into very close contact with them.

Evidence in favour of variation in the length of the

period of incubation is to be derived from the history of certain school epidemics reported to the committee; the best example is the epidemic outburst recorded by Dr. Newman (Cases 68 to 82). The outbreaks recorded by Dr. Armstrong at Wellington College (Cases 10 to 21), and by Dr. Stedman at Leatherhead (Cases 22 to 28), also afford some evidence on this head, though the periods of exposure were longer.

Table III contains cases in which the exposure to infection ceased at a known date, generally at or about the time of the first appearance of the rash. Any value they may possess attaches only to those which show unusually long periods. In seven cases the period of incubation indicated by the facts as reported is longer than fifteen days. In three of these seven cases the sufferers were pupils at a school at which a case had occurred (Cases 21, 27, 28), and it seems very improbable that any other case, or any source of infection in fomites was overlooked. In Case 124, Dr. Squire who reports it, suggests that the period may have been prolonged by an intercurrent attack of influenza. In Cases 101 and 102 the only source of fallacy that suggests itself is that the infection may have been derived from clothes taken into use at some date after the commencement of the voyage, as in the epidemic of scarlet fever on board ship recorded by Dr. Murchison (q. v., p. 169). In Case 104 it does not appear whether certain children who had the disease in the depôt before the ship started sailed in the ship or no.

In 22 of the cases the infector was isolated as soon as the rash appeared; the interval between such isolation and the appearance of the rash was as follows:—In 1 case ten days; in 5 cases eleven days; in 4 cases twelve days; in 5 cases thirteen days; in 3 cases fourteen days; in 1 case fifteen days; in 1 case sixteen days; in 1 case seventeen days; and in 1 case eighteen days. If the most common interval between reception of infection and the appearance of the rash be taken to be fourteen days, these figures would appear to indicate that the liability of susceptible persons to contract the disease is about equally great on each of the three days preceding the day on which the rash is first noticed.

With regard to the true period of incubation, that is to say, the interval between the exposure to infection and the first symptoms, it will be seen on comparing these two tables (II and III) that there is in many instances a correspondence between the duration of this period and of that intervening

between the exposure and the appearance of the rash. The exceptions are, however, very numerous, and it does not appear to be possible to formulate any general rule. The true incubation periods shown by the cases vary within very wide limits, from four or five to thirteen or even sixteen days.

TABLE III.—*Showing cases in which exposure to infection ceased at a known date, showing subsequent interval before rash or early symptoms.*

No. of case.	Days between cessation of exposure and first symptom.	Days between cessation of exposure and rash.	Remarks.
22	—	10	Infector removed when rash appeared.
109	—	10	Exposure ceased day before rash.
101	—	10	At sea; source of infection unknown.
10	—	11	Infector isolated when rash appeared.
11	—	11	Ditto.
12	—	11	Ditto.
23	—	11	Infector removed when rash appeared.
24	—	11	Ditto.
13	—	12	Infector isolated when rash appeared.
14	—	12	Ditto.
25	—	12	Infector removed when rash appeared.
26	—	12	Ditto.
95	—	12	Patient removed from infected neighbourhood.
107	9	13	
113	9	13	A few days before measles.
8	12	13	Infector isolated when rash appeared.
9	12	13	Patient removed day after rash appeared in infector.
15	—	13	Infector isolated when rash appeared.
16	—	13	Ditto.
17	—	13	Ditto.
18	—	13	Ditto.
31	12	13	Patient removed on fourth day of infector's rash.
103	—	13	At sea; source of infection unknown.
110	10	13	Exposure ceased day before rash.
6	12	14	Infector isolated when rash appeared.
7	12	14	Ditto.
19	—	14	Ditto.
108	13	14	
20	—	15	Infector isolated when rash appeared.
127	11	15	
27	—	16	Infector removed when rash appeared.
28	—	17	Ditto.
21	—	18	Infector isolated when rash appeared.
124	16	18	
101	—	18	At sea; source of infection not traced.
104	—	19	At sea; facts as to isolation of previous cases not stated.
102	—	22	At sea; source of infection not traced.

Duration of Infectious Period.

A patient is infectious for several days before the appearance of the rash of measles; this is so generally accepted that it appears hardly to be necessary to quote instances. A glance at the two tables given above will afford many, and Dr. Murchison's Group III is a very striking example; in commenting on it he remarks that it illustrates "the extreme contagiousness of measles in its primary or catarrhal stage." It may be added that the catarrhal symptoms may be of a very slight kind, and yet the sufferer may be able to infect others. In Cases 38, 39, 40, 41, 42, the symptoms were so slight that the persons who infected the others were able to attend evening parties. In Case 45 the child "had no symptoms which attracted attention." The exposure occurred in some cases on the first, in others on the second, and in others again on the third day before the rash; Cases 45, 119, and 127 are examples in which the patient from whom the infection was derived did not develop the rash of measles until three days after the occasion on which the person who subsequently suffered was exposed. In Cases 40, 41, 42, 67, and 68 to 82 the exposure took place two days before the rash. The same holds good for Dr. Murchison's Group III.

Infection is much less often derived from a patient convalescent from measles. The cases communicated to the committee, however, afford a few instances.

No. of case.	Nature of exposure.	Interval to rash.
3.	—Was, for a few hours, with children supposed to have recovered .	14 days.
5.	—Spent a few hours at a school in which there had been an epidemic; the last case had rash 17 days before . . .	14 „
37.	—Danced with a man just convalescent	14 „
44.	—Contracted the disease from brothers, who had probably taken it from a boy who returned to school convalescent . .	12 „
96.	—"Desquamating from a recent attack of measles" . . .	11 „
125.	Was in same class at school as a boy who was allowed to return	
126.	20 days after sickening	10 „

On the other hand, Dr. Squire gives two striking histories (Cases 121, 122, 123), which tend to prove that a patient has ceased to be infective three weeks after the appearance of the rash.

Mode of infection.—The mode of infection in the great majority of cases is personal intercourse. Dr. Murchison gives a

history (Group IV) communicated to him by Dr. Bristowe which seems to prove pretty conclusively that the infection can be conveyed by fomites, and possibly the circumstance related in the second paragraph of Dr. Stretton's communication (see under Case 96) may be another example, but the occurrence must be rare.*

Conclusions.

The general conclusions which appear to be warranted by the reports received are—

1. The interval between exposure to infection and the appearance of the rash of measles is more often fourteen days than any other period, but it is not infrequently a day more or a day less. Intervals of sixteen, seventeen, and eighteen days probably occur occasionally, and in considering the question of the isolation of susceptible persons who have been exposed to infection the possibility of such periods cannot be left out of account. In rare cases the interval may be as short as seven days.

2. The primary, prodromal, or catarrhal stage varies in length from one to five days, so that in calculating the true period of incubation of measles a deduction must be made from the intervals above mentioned. The amount of this deduction cannot be stated in general terms, for the duration of the primary stage does not bear any constant relation to the duration of the interval between exposure and the appearance of the rash. The true incubation period of measles is, in a majority of cases, nine or ten days, but may be as short as five or even four days, and as long as fourteen. A susceptible person who has been exposed to the infection of measles must be kept under observation for a full fortnight, and be found free from fever and catarrh at the end of that period, before it can be said that the disease has not been contracted.

3. Measles is very infectious during the primary period, and probably not less so during the whole acute attack. A

* It is possible that for short distances, as from one ward of a hospital to another, infection is more easily and frequently conveyed by fomites, *i. e.* by the dresses of attendants. Further, it is difficult to account for some of the outbreaks in children's hospitals except on the supposition that the infection is brought in by visitors. The circumstances here, however, are so complicated that no instances have been given in the text. The question has been discussed by M. Grancher (*Bull. Méd.*, 1889, and *Bull. de la Soc. Méd. des Hóp.*, 1889).

patient who has had measles is capable of conveying the infection after convalescence has advanced far enough to enable him to resume his usual avocations, but this liability ceases probably within about three weeks of the appearance of the rash if disinfection has been practised.

4. There is considerable probability that fomites are capable of retaining the infection, at any rate for a short time.

CASES.

Cases 1 *and* 2.

Communicated by Dr. C. B. Smith, Wexford, 1878.

A boy sent home from service, having been ill six or seven days with measles, arrived on February 8; he died on February 14, and was buried February 15; the house was cleaned and fumigated. On February 20 his brother and sister (*Cases* 1 *and* 2) had first symptoms of measles. This was twelve days after infector's arrival, six days after his death, five days after his burial and the fumigation of house. No previous case of measles in Dr. Smith's district "for months."

Cases 3 *to* 8.

Communicated by Dr. Lowndes, Egham.

[These cases are the same as Groups I and II, given by Dr. Murchison in the *Transactions of the Clinical Society*, vol. xi, p. 242.]

On January 7, 1878, M. (*Case* 3) was for "a few hours and at lunch" visited by two other children who "were supposed to have recovered from measles." On January 10 he returned to school, where he became ill on January 20 (thirteenth day), and had distinct measles the next day, January 21. This was the first case in an epidemic in the school. He was isolated in sanatorium on January 21.

The second case in this epidemic (*Case* 4) began to sicken on February 2 (thirteenth day from early symptoms of Case 3); unmistakable rash on February 4.

Reporter's son, aged $16\frac{1}{2}$ (*Case* 5), visited the school to see a theatrical performance at which some of the boys were present. The last case in the school had had rash on February 18; the theatrical performance was on March 5; Case 5 was indisposed on March 15 (tenth day), had a cold and cough on March 16, and rash on March 19th. He was isolated on that day.

Child aged $6\frac{3}{4}$ (*Case* 6), living in the same house as Case 5, was indisposed on March 31 (twelfth day from rash of Case 5) and had rash April 2 (fourteenth day).

Child aged $4\frac{1}{2}$ (*Case* 7) exposed in same way as Case 6; indisposed March 31; rash April 2.

Child aged $2\frac{1}{2}$ (*Case* 8) exposed in same way as Cases 6 and 7; indisposed on March 31, and had rash on April 1 (thirteenth day from rash of Case 5).

Case 9.

Communicated by Dr. H. E. Armstrong, M. O. H., Newcastle, 1878.

Reporter's daughter, aged 3 (*Case* 9), was staying in Sunderland in a house with two children who had measles rash on November 11. She was taken home to Newcastle on November 12. She was indisposed on November 23 (twelve days from donor's rash), had a slight rash, nature of which was doubted on November 24 (thirteenth day); was well on November 30. Nature of illness proved by occurrence of well-marked measles in her infant sister on December 12.

Cases 10 *to* 21.

Communicated by Dr. H. G. Armstrong, M. O., Wellington College, 1889.

On February 7, 1887, the twelfth day of term, a boy appeared with the rash of measles, and was immediately isolated. The rash appeared in three boys (*Cases* 10, 11, 12) on February 8, the eleventh day from infector's rash; in two boys (*Cases* 13, 14) on February 19 (the twelfth day); in four boys (*Cases* 15, 16, 17, 18) on February 20 (thirteenth day); in one boy (*Case* 19) on February 21 (fourteenth day), in one (*Case* 20) on February 22 (the fifteenth day), and in one (*Case* 21) on February 25 (the eighteenth day). No case occurred in the village, so far as was known, which renders it improbable that infection was carried to the College from that source, and highly probable that the case of February 7 was the origin of the epidemic.

Cases 22 *to* 28.

Communicated by Dr. A. Stedman, Leatherhead, 1889.

Boy, R., at school, sent home with measles rash November 12. Cases occurred among seven other children at the school, rash being "out" in one (*Case* 22) on November 22, in two (*Cases* 23, 24) on November 23 (eleventh day), in two (*Cases* 25, 26) on November 24 (twelfth day), in one (*Case* 27) on November 28 (sixteenth day), and in one (*Case* 28) on November 29 (seventeenth day). The schools were closed on November 23, and there was an eighth case on December 5, but the source of infection may have been one of the children, who had the rash on November 22, 23, or 24.

Cases 29 *and* 30.

Communicated by Dr. J. W. Carr, London, 1889.

A boy, G. J., aged 1 year (*Case* 29), was admitted to the Victoria Hospital for Children on January 28 for bronchitis; he had not had measles, and his parents stated there was no measles in their house. On February 13 another boy was admitted to the same ward; early on February 15 he "developed the rash of measles, and was at once discharged." G. J.'s temperature rose to 100·6° F. on February 22, and continued between 101° and 103° F., with some diarrhœa until February 26, when the rash of measles came out, with a temperature of 102·8° F. There had been no case of measles in the hospital for the two months previous to February 13.

F. C. (*Case* 30) admitted to Victoria Hospital for Children, October 3, from the country, for pneumonia; he was allowed up on October 26. On October 29 a boy was admitted to the same ward, who on October 31 developed rash of measles. F. C. sat beside this boy's bed on October 29 and 30. On November 3 his temperature rose to 103° F.; irregular pyrexia continued one week, and on November 10 measles rash appeared.

Case 31.

Communicated by Dr. G. W. Armstrong, Royal Hospital Schools, Greenwich.

C. D., a boy aged 11, whose brother came out with measles rash on August 28, returned from home, where he had been with his brother, to school on August 31; had headache on evening of September 12, and coryza and rash on the following morning. There was no other case of measles in the school.

Cases 32 *to* 36.

Communicated by Dr. C. H. Watts Parkinson, M. O. H., Wimborne.

F., a girl, was sent home from service on November 12; she then had rash of measles out. The house was a small isolated cottage in a sparsely inhabited heath country. There was no case of measles in the neighbourhood. Nine days later, on November 21, the five other children (*Cases* 32 *to* 36) in the cottage became unwell, and on November 24, the twelfth day, the rash of measles appeared on all five within a few hours of each other.

Cases 37 *to* 39.

Communicated by Dr. Fred. Wilkinson, M. O. H., Lewisham.

A young lady (*Case* 37) danced several dances with a gentleman just convalescent from measles on January 1. On January 14 she went to a children's party, and on January 15 she had the rash of measles. The two children (*Cases* 38, 39)—of different families—who had sat on either side of her at supper on January 14 had measles fourteen days later.

Cases 40 *to* 42.

Communicated by Dr. Adams Clarke, Bushey.

On January 7, 1889, E. C., a girl aged 10 (*Case* 40), was at a dance, and at supper sat next to a little girl who on January 9 had the rash of measles well out. On January 17 E. C. had headache, anorexia, general catarrh, and cough, and on January 22 measles-rash appeared. The absence of any other source of infection than the child at the dance is stated to be absolutely certain. The interval to prodromal symptoms was ten days, to rash fifteen days.

S. H., a boy aged 14 (*Case* 41), and C. P., a boy aged 10 (*Case* 42), were at the same dance, and danced with the little girl above mentioned; they are believed not to have been exposed to infection at any other time. Both S. H. and C. P. sickened on January 17 (tenth day), and showed rash on January 22 (fifteenth day).

Case 43.

Dr. E. A. Welch, Worcester, Mass., U.S.A.

D. G. H. (*Case* 43), a medical student, examined several cases of measles during a visit to a children's hospital on December 5, 1888. He is confident he had not been in contact with other cases "for at least a month previous." He had never had an attack of the disease. On December 12 (seventh day after exposure) he felt indisposed, had headache and coryza on December 13, and on December 15 the eruption began to appear on his face (tenth day).

Cases 44 *and* 45.

Communicated by Dr. F. Pearse, London.

On April 21 two boys, C. and H., returned home from school, where they had been for a week with a boy who had returned to school convalescent from measles on April 16. C. had coryza on April 24 and rash on April 28. H. had rash on April 29. D. (*Case* 44), a younger brother of C. and H., was in association with them from April 21 to April 27,

when they were separated from D. On May 6 (twelve days after C. had prodromal symptoms and nine days after C. and H. were isolated) D. had "a cold," and on May 10 (sixteen days after prodromata in C., and thirteen after C. and H. were isolated) the marked rash of measles developed.

On December 25 two children, A. and B., of one family played with C. (*Case* 45), a child of another family. A. at that time had no symptoms which attracted attention, but on December 28 A. had rash of measles (B. had rash on January 8). On January 5, the eleventh day from playing with A., C. was "taken poorly," and on January 8, the fourteenth day from playing with A., showed the rash of measles unmistakably. B., though exposed earlier and later than C., was apparently infected at the same time.

Cases 46 *to* 50.

Communicated by Dr. CLEMENT DUKES.

P., a boy, returned to school on January 19, 1888, at 7 P.M., coming from a village where there was measles. He mixed with his fellows for nineteen hours, *i. e.* up to 2 P.M. on January 20, when Dr. D. found him "covered with rash," and took him to hospital. On February 2, fourteen days from P's return, four other boys (*Cases* 46, 47, 48, 49) had the rash of measles, and were isolated. These five boys were all at the same master's house. There was, however, another centre of infection in the school at this time, but in a different master's house, viz. :—

P., a boy who returned to school on January 19, had measles rash on January 23, and was isolated on that day. On February 4, B., a boy (*Case* 50) who lived in the same study as P., had the rash, *i. e.* sixteen days after P. returned to school, and twelve days after he was isolated.

Cases 51 *to* 54.

Communicated by Surgeon BAKER, A.M.D.

An epidemic among soldiers' children in barracks, introduced by children living in the town (Winchester), but attending the regimental school. V. was ailing on October 29, and had rash on November 1. *Cases* 51 and 52 were a sister (aged 3) and brother (aged 7 months) of V.; both sickened on November 10 (twelve days after first symptoms in V.), and had rash on November 13 (fifteen days after first symptoms in V.).

Same epidemic. X. was ailing on October 27, and had rash on October 30. *Case* 53, his sister, aged 3, was ailing on November 9 (thirteenth day from first symptom), and had rash on November 11 (fifteenth day). *Case* 54, a boy aged 1 year and 5 months, lived in a room immediately above X.; he was ailing on November 11 (fifteenth day from first symptoms in X., and had rash on November 14 (eighteenth day).

Cases 55 *to* 61.

Communicated by Dr. J. W. ALLEN, Hampstead.

An epidemic in a family. The first case had rash on January 4, after prodromal symptoms for three days; source of infection unknown. *Case* 55 had rash on January 13 (ninth day from rash);

Cases 56, 57, 58, 59 on January 14 (tenth day); *Cases* 60 and 61 on January 19 (fifteenth day).

Case 62.

Communicated by Dr. F. R. Humphrey.

"N. H., aged 4, returned home on August 29 from a measles-infected locality. Developed measles rash and a cough on September 2. The baby sister (*Case* 62) of N. H. was taken ill on September 5 with measles, only surviving a few days."

Cases 63 *to* 65.

Communicated by Dr. W. Vaudrey Lush.

"A. T. (*Case* 63), an adult, visited a case of measles. Ten days afterwards eruption appeared on A. T."

C. T. and E. L. (*Cases* 64, 65), both adults, entered a shop together in a room off which was a child coughing; "shopkeeper stated that she thought her child was going to have measles." Ten days afterwards the rash of measles appeared on both C. T. and E. L., who had parted company on the day of their exposure to infection.

Case 66.

Communicated by Dr. P. O'Connell, Chicago.

On the evening of January 20, 1889, "Eddie M., aged 3 years, spent fifteen minutes in a room with a child sick with measles. On February 1 the rash of measles began to appear on his face. Neither directly nor indirectly was there any previous or subsequent exposure to infection."

Case 67.

Communicated by Dr. Vachell.

A groom (*Case* 67) spent two nights and a day at the village of Peterstow, at a time when there was an epidemic of measles in a neighbouring village two and a half miles away. Two children of the Peterstow station-master's were attending school at the infected village, and developed measles rash on February 20. The groom spent some time in the company of these children on February 18. On March 5, sixteen days later, the groom developed measles rash at the house where he was employed near Cardiff (nine miles from the village where the epidemic was).

Cases 68 *to* 94.

Communicated by Dr. W. Newman, Stamford.

On Sunday, December 30, 1888, seventeen children were together at a small Sunday school. One child, then unsuspected, showed measles on Tuesday, January 1, 1889. One child had had measles before, and escaped infection. The remaining fifteen (*Cases* 68 to 82) took measles in the order indicated in the following table, in which the date of each case is given; the table shows in a graphic manner the relative frequency of attacks on the several days. Thus there were 2 on the thirteenth day, 8 on the fourteenth day, 3 on the fifteenth day, 1 on the sixteenth day, and 1 on the eighteenth day.

Jan. 12	Jan. 13	Jan. 14	Jan. 15	Jan. 17
Jan. 12	Jan. 13	Jan. 14		
	Jan. 13	Jan. 14		
	Jan. 13			
	Jan. 13			
	Jan. 13			
	Jan. 13			
	Jan. 13			

Dr. Newman also gives the following cases:

	Exposed to infection on		Rash appeared		
A (*Case* 83).—	Dec. 27, 1888	...	Jan. 7, 1889	...	11 days.
B (*Case* 84).—	Jan. 6, 1889	...	Jan. 17, 1889	...	11 ,,
C (*Case* 85).—	Jan. 6, 1889	...	Jan. 17, 1889	...	11 ,,
D (*Case* 86).—	Jan. 7, 1889	...	Jan. 18, 1889	...	11 ,,
E (*Case* 87).—	Jan. 17, 1889	...	Jan. 26, 1889	...	9 ,,

In a family of eight children one was taken ill with measles; twelve days after four children (*Cases* 88, 89, 90, 91) showed the rash. Twelve days after these four, the remaining three children (*Cases* 92, 93, 94), showed the rash.

Case 95.

Communicated by Dr. J. H. Gornall.

A boy, aged 12 (*Case* 95), received serious contusions in a railway accident on March 1, and was admitted into the Warrington Infirmary on that day. On March 13, while still in hospital, and convalescing from the accident, and without so far as was known being exposed to contagion in the hospital, he "broke out with measles, with the usual symptoms, coryza, &c." Measles had been prevalent in the neighbourhood where he lived, but he had not been visited by anyone except his parents.

Case 96.

Communicated by Dr. Stretton.

A girl, X., aged 11, returned home from school on March 14, desquamating from a recent attack of measles. A boy, aged 2½ (*Case* 96), was in the room when this girl was undressed on March 14; he "came out with full crop of measles on March 25." The period of incubation cannot have been more than eleven days.

A dressmaker finished some dresses while herself ill in bed with measles. The lady who received them occupied the same bedroom as her niece; the dresses were shaken out and placed on the bed. The niece had measles within about (probably) twenty-four or twenty-five days. Another girl (X. of last instance), on December 26, 1878, slept in the room previously occupied by the aunt and niece. X. had measles rash on or about January 18. (Dates are from patient's memory.)

Case 97.

Communicated by Dr. F. W. Thurnam.

A boy, A., aged 3½ (*Case* 97), was admitted into the London Fever Hospital on January 19th, suffering from the after effects of scarlatina, with which he had been attacked fourteen days earlier. He was placed

in a scarlet fever ward in which several cases of measles had not long before broken out. On January 23 a patient in this ward developed symptoms of measles. On January 24 A. was removed to another ward. On February 6 his temperature rose to 101·6° F. On February 7 there was indistinct rash and slight coryza; on February 8 the rash was well marked (sixteen days after rash in earlier case, fifteen days after removal from infected ward, and twenty after admission to hospital).

Cases 98 *to* 100.

Communicated by Dr. G. C. Henderson.

A scarlet fever ward in the London Fever Hospital became infected with measles, through certain children who developed measles from a week to ten days after commencement of scarlet fever.

On December 13 N. M., aged 3 (*Case* 98), was admitted into this ward suffering from scarlet fever; he was convalescent on December 17, but his temperature rose again on December 27, his face became puffy, conjunctivæ injected, and cough and coryza set in. On December 31 measles rash appeared. (First symptom fourteen days after admission, rash eighteen days after.)

On December 24 David W. (*Case* 99), aged 1½, suffering from scarlet fever, was admitted into the ward. He was convalescent on December 27. On January 7 his temperature rose to 102·2° F., and he had cough, coryza, injection of conjunctivæ, and puffy lips. On January 11 a faint papular rash, which was distinctly that of measles next day, was noticed. (First symptoms fourteen days after admission, rash eighteen days after admission.)

Percy B., aged 8 (*Case* 100), suffering from scarlet fever, was admitted to the same ward on January 8. He was convalescent on January 11. On January 23 his temperature rose to 103° F., and he was sick and out of sorts. On January 26 a measles rash appeared. (First symptoms fifteen days after admission, rash eighteen days after admission.)

Cases 101 *to* 104.

Communicated by Dr. W. H. Pearse, Plymouth.

Ship "Oasis," Calcutta to Demerara, carrying 249 men, 76 women, 43 children between one and ten years, and 33 infants, sailed on September 2, 1865. On September 20 a European apprentice (*Case* 101) showed measles, and on September 24 a coolie child (*Case* 102). These dates are those on which the eruption first showed. There were no other cases. (The first case eighteen days, and the second case twenty-two days after sailing.)

Ship "Hamburgh," Plymouth to Melbourne, carrying 412 persons, including 86 children under twelve, of whom 54 were under seven years, sailed on July 31, 1870. The children entered the depôt at Plymouth on July 25, and had no subsequent communication with "the outside world." The first case of measles (*Case* 103) occurred on August 7 (thirteen days after entering the depôt).

Ship "Liverpool," Calcutta to Trinidad, carrying 538 persons, including 35 children and 9 infants. Passengers entered the depôt on September 4, 1867, and had no subsequent communication with the outside world. While in depôt four cases of measles occurred among the passengers of this ship and others, 1000 in all, in the depôt. The

ship sailed on September 7; the first case of measles (*Case* 104) showed itself on September 23 (nineteen days after entering depôt). It does not appear, however, whether the four patients ill at the depôt or any of them sailed in the "Liverpool."

Cases 105 *to* 127.

Communicated by Dr. William Squire.*

A girl, B. (*Case* 105), aged 12, returned home on January 24, 1865, after an absence of at least three weeks; a younger sister had commenced to be ill with measles on January 19, and had the rash on January 22. B. had feverish disturbance on January 27, catarrhal symptoms on January 28, and rash on January 31, seven days after return home. Another sister (*Case* 106), much with the first sufferer, and a brother who sickened at the same time and had also been exposed throughout, had the rash on February 1, a day after their sister B., whose exposure commenced at a later date.

A boy, aged $7\frac{1}{2}$ (*Case* 107), attended school daily until October 24, 1868, on which day one of the boarders complained of illness, which was known to be measles on October 26. Case 107 was not at the school on October 25 or 26, but called for his books on October 27. He vomited on October 31, was ailing on November 2, and had full rash on November 6—thirteen days after last day at school. His brother (*Case* 108), aged 5, was last at school on October 24, had initial fever on November 2, high fever on November 6, and rash on November 7—fourteen days after last visit to the school. A sister, aged 6, of these two boys (*Case* 109) was with them until November 4, when she was not allowed to enter their room, and was removed to another house on November 5. She had the rash on November 15, ten days after complete isolation. Another brother, aged $1\frac{3}{4}$ (*Case* 110), isolated at the same time as Case 109, had the rash on November 18, thirteen days after isolation. He had begun to be ill on November 15.

A boy, aged 12 (*Case* 111), left school, where there had been measles, on March 20, 1869. He was dull on March 27, and had rash on March 30, ten days after the cessation of exposure. A boy, aged $6\frac{1}{2}$ (*Case* 112), was with Case 111 from March 26 to 29; he had some initial fever on April 4, the usual symptoms on April 7 and 8, and full rash on April 9, eleven days after cessation of exposure, and fourteen after its commencement.

A girl, aged 6 (*Case* 113), until May 10 was much in the company of a child who had measles a few days later. Case 113 had fever on May 19, cough on May 21, coryza and rash on May 23, thirteen days after cessation of exposure.

A girl, aged 4 (*Case* 114), on February 19, 1872, was taken to see a brother in another part of London, but only remained half an hour, as he was found to have the rash of measles full out. Ten days after, on March 1, she sneezed, on the next day she had headache, and on March 4, fourteen days after exposure, she had the rash full out. A brother, aged 8 (*Case* 115), exposed in the same way, complained of illness on March 4, and the rash began to appear on the following day, fifteen days after exposure.

* *Cases* 105 to 123 have already been published by him in his *Essays in Preventive Medicine*, p. 64, *et seq.*

Infection during catarrhal stage.—A girl, aged 6 (*Case* 116), ceased to attend school on November 25, had the first signs of measles on December 4, 1871, nine days after last attendance, and the rash on December 6, eleven days after last attendance. A girl, aged 6 (*Case* 117), visited this girl on December 3, when she had cough only. On December 14 Case 117 was ill, and had rash of measles on December 17, fourteen days after exposure. A boy, aged four (*Case* 118), brother of last case, was exposed in the same way and at the same time; he had the rash on December 14, eleven days after exposure.

Infection in prodromal stage.—A boy on a visit was ailing on February 13, and was sent home; he had rash of measles on February 16. From February 9 to 12 he slept in the same room as a girl aged 10 (*Case* 119), but was separated from her on that day. She had fever on February 20, coryza on February 24, twelve days after cessation of exposure, and rash on February 24.

A boy, aged 6 (*Case* 120), ceased to attend school on November 17, 1871, on account of measles and whooping-cough in the school. He coughed and was sick on November 29, was feverish on December 4, had the first signs of measles on December 5, and the full rash on December 6, nineteen days after ceasing to attend school.

Limited duration of infection.—Two girls, aged 14 and 11 (*Cases* 121 and 122), were brought home from school with the rash of measles fully out on January 30, 1872. Three other children remained in the house while these two girls were ill, but were isolated. After three weeks the two girls were allowed to mix with these three children, as well as with two others that had been sent away; no fresh cases occurred, showing apparently that the two who suffered had ceased to be infective.

A boy, aged 9 (*Case* 123), who had measles at school was allowed to return home and mix with his eight brothers and sisters exactly three weeks after his rash had been at its height. His clothes had been "efficiently exposed" to the fumes of burning sulphur, and he had washed with carbolic soap. None of his brothers or sisters took measles.

A lad, aged 15 (*Case* 124), was staying in a house in which a case of measles occurred on January 2, 1890. The case was isolated that day, and Case 124 was sent to London on January 4; on the following day he had influenza.* He had some fever again on January 12; on January 20 he had bronchitis, sixteen days after cessation of all exposure, and eighteen after isolation of the case from which he is believed to have contracted measles. The rash appeared on January 22. Dr. Squire suggests that in this case the incubation period of measles was lengthened by the intervening attack of influenza.

R., a boy aged 14, sickened with measles at school on January 21, 1888, and was isolated until February 10, when he went back to his class. Two fresh cases (*Cases* 125 *and* 126) occurred on February 20; the interval between exposure and sickening was ten days.

R. H. sickened for measles on October 20, 1888, and had the full rash on October 24. His sister, F. H. (*Case* 127), who was much with him on October 20 and 21, had fever on November 1, cough on November 3 and 4, and rash on November 5, fifteen days after assumed cessation of exposure.

* See Influenza, *Case* 73.

The following cases were communicated to the Society by Dr. MURCHISON in 1878.

GROUP III.—There was a party of about twenty children at the house of Mr. D. One of the children was in what turned out to be the second day of the catarrhal stage of measles, the rash not appearing until a day or two later. About twelve days afterwards almost all of the remaining children who were at this party were attacked with measles. Two of these children, while suffering from catarrh, but two days before the appearance of the rash, were present at another juvenile party at the house of Mr. F., and fourteen days afterwards several of the other children who attended this party sickened with measles, the rash of which appeared four days later.

GROUP IV.—In the spring of 1876 a little girl who had been away for the Easter holidays returned to school. She came about 2 in the afternoon, and was sent home about 6 on the same day, either because she had the rash of measles upon her, or because she was ill with symptoms which developed later into measles. At that time all Dr. B.'s children, excepting the three youngest, had had measles, and five of those who were not susceptible were attending the school. When dressed to come home at 4 o'clock Dr. B.'s eldest daughter went and talked to the little girl referred to on the stairs, and on reaching home the eldest of the three susceptible children went into her bedroom and helped her to put her clothes away. That day fortnight this little girl sickened with measles, and on the same day several of the pupils at the school were also attacked. About a fortnight later Dr. B.'s two youngest children were taken ill with what was thought to be a very slight attack of measles.

MUMPS.

IN attempting to ascertain the duration of the period of incubation in mumps some uncertainty must arise owing to the indefinite character of the earliest symptoms, those, namely, which occur before a distinct swelling of the parotid can be observed. Though ill-defined, and often very slight, a person who is suffering from them is capable of infecting others. A patient will frequently assert that he has been perfectly well until the sudden onset of the disease with high temperature and pain in the parotid region; in many, in fact in the majority, of the cases communicated to the Committee the only date known is that of the commencement of swelling in the glands; it has, therefore, been necessary to calculate the interval between exposure to infection and the appearance of the parotitis.

Incubation period.

The incubation period of mumps is generally said to extend to two or three weeks; the cases contained in this report tends to prove that it approaches more nearly, as a rule, to the latter than to the former.

In Table I have been brought together all the cases in which the disease followed a single short exposure. The cases are fourteen in number; in nine the interval between exposure and the parotid swelling was about three weeks, a day or two more or a day or two less; to this number Case 88 may be added, in which the date of the first symptoms is stated to have been eighteen days after exposure. In three cases, however, the interval was more nearly two weeks. The cases, however, are too few in number to warrant us in drawing any conclusions, and it becomes necessary to rely chiefly upon cases in which exposure ceased at a known date. The number of such cases is large, and the Committee is especially indebted to Dr. Clement Dukes for a long and valuable series. Taking all the cases of this kind it will be found that every interval,

from twelve to twenty-five days, is mentioned by one or other of the observers who have communicated with the Committee.

TABLE I.—*Showing the cases in which the disease followed after a stated interval a single or short exposure to an infected person.*

No. of case.	No. of days between exposure and First symptom.	Swollen face.
9	11	—
121	—	14
122	—	16
2	—	17 or 18
88	18	—
83	—	20 to 22
5	—	21 or 22
6	—	21 or 22
84	—	21 to 23
50	—	22 or 23
15	—	23
49	—	23 to 25
85	—	23 to 25
86	—	23 to 25

In the following table the Nos. of the cases are arranged under the various days; the height of each column will indicate approximately the relative frequency of the onset of the parotitis on each day:

TABLE II.

Days	12	13	14	15	16	17	18	19	20	21	22	23	24	25
								4						
								117						
							113	116						
							112	115						
							111	114						
						107	110	71						
						106	109	65						
						105	108	59						
						104	64	58	123					
						91	63	56	118					
					103	76	61	54	77	134				
					102	75	52	53	68	120				
					101	74	47	37	67	119				
					100	60	46	35	66	78			82	
			98		99	45	42	29	44	72			81	
			90		55	39	41	28	43	69	80		70	
		135	33	62	34	38	40	27	32	25	79		57	
	17	89	18	51	19	36	31	1	30	24	73	15	26	48

The only cases of this order which do not appear in the above table are the very exceptional group Cases 10 to

14; it is, perhaps, legitimate to suspect that there may have been some undiscovered source of infection at a later date in these cases, standing as they do separated from all others by an interval of at least a week.

Attention may also be directed to cases in which the person infected has been exposed to a source of infection continuously, or at least for several days at the commencement of the illness in the infector. Evidence has been met with in certain other diseases that the period of incubation may, under such circumstances, be shorter than after a short exposure. In mumps, however, there is no distinct evidence of such an occurrence, though the dates in the cases contained in the following table, which is arranged on the same principle as the preceding one, are not incompatible with the hypothesis indicated :

TABLE III.

				127									
				95									
				17		96							
				16		93	129						
				8		92	128	130	131				
		124	7	3		18	94	19	97		132		133
		^	^	^		^	^	^	^		^		^
Days	...	14	15	16	17	18	19	20	21	22	23	24	25

Though the number of cases is too few to warrant any direct statistical comparison between the two tables, it may be observed that the shortest and average periods of incubation in the cases of prolonged exposure are well within the limits indicated by the cases in which exposure was of brief duration, or ceased at the time of onset of distinct symptoms.

Taken together, the facts embodied in the above tables show that account must be taken of the possibility of a period of incubation exceeding three weeks in estimating the length of time for which a susceptible person, who has been exposed to the infection, must be kept under observation before he can be declared free from the liability to develop the disease. A period of observation of four weeks, however, is, probably, ample. The statement might be made absolute were it not for the cases numbered 10 to 14, which seem to show that the incubation period may be extended for at least a week beyond the four weeks above mentioned; these cases are, however, as has already been pointed out, quite exceptional, and the

assumed long interval may be due to some error of observation, of the kind suggested above.

Duration of Infectiousness.

The cases sent to the Committee afford ample proof, if such were needed, that mumps is infectious at a very early stage. Thus, in the series of cases communicated by Dr. Clement Dukes, the infector was in every instance isolated in the school sanatorium as soon as he complained of illness or was observed to be ill. In *Cases* 4, 5, 6, 24, 25, 26, 83, 84, 85, 86, and in Dr. Stedman's cases (98—120) the infection must have been derived from a case in a very early stage. Certain of the cases also show that the infection may be conveyed before any complaint is made, and when the person about to suffer believes himself to be in perfect health. Examples of this are afforded by Cases 2, 13, 14, 15, 50, 83, 84, 85, 86 ; in one case (15) there is a presumption that the infection was derived from children at least four days before they had mumps.

Evidence of secondary value in favour of the conclusion that mumps is most highly contagious in the early stage may be drawn from the cases in which exposure to the infected person continued throughout the illness, or for a considerable period. It will be seen from an examination of these cases, which are collected in Table III, that the interval given is compatible with the assumption that the disease was contracted, either while the infector was in an early stage of the developed disease, or, possibly, during the few days before the parotitis declared itself. The shortest period between the occurrence of parotitis in the infector and in the infected person is fourteen days, and the longest twenty-five days—both dates within the limits which, on other grounds, must be assigned for the variation in the period of incubation in mumps.

In no one of the cases was the infector in a late stage of the disease or convalescent, unless Case 9 be an exception ; in this case the child from whom the infection is believed to have been derived had been ill nine days, and the period of incubation, according to the facts stated, was shorter than usual—eleven days ; some suspicion may be felt as to whether the patient may not have been exposed to some other source of infection at an earlier date, for the case is exceptional in two respects—the assumed short period of incubation, and the stage of the disease in the supposed infector.

Direct evidence that infection does not persist during

convalescence is afforded by Cases 136 and 137. In these cases boys returned home, and associated with other children, a fortnight and three weeks, respectively, after the date of onset of the parotitis, yet none of these other children were infected.

It would appear also that very simple precautions are sufficient to prevent the spread of the disease. Dr. Clement Dukes' cases, on the whole, prove this, since in a school, with many susceptible boys associated together more or less intimately, it was generally possible to discover some more than customary closeness of intercourse between the first cases and the boys who subsequently suffered. In the interesting family epidemic reported by Dr. C. E. Hoare (Cases 16 to 26) two distinct outbreaks occurred; four cases commenced from sixteen to twenty days after the onset of parotitis in the first case, and seven more cases began from nineteen to twenty-four days after these four cases. Here isolation, though only in the same house as the patient, and not commenced until the day on which mumps was recognised (the third day of illness in this case) was effectual as regards seven out of ten persons who were all susceptible.

Conclusions.

(1) The interval between the exposure to the source of infection and the onset of parotitis in mumps is most commonly about three weeks, a day more or a day or two less. It is occasionally as long as twenty-five days, and more rarely as short as fourteen days.

(2) The primary or prodromal stage is of very uncertain duration, it may last three or four days or may be entirely absent. In practice, in order to obtain a fixed date from which to make calculations, it is necessary to take the date of onset of the parotitis.

(3) Mumps is very infectious at the time of onset of the parotitis, and during the prodromal stage which, in order to be on the safe side, should be assumed to be four days. The chance of infection diminishes progressively from the onset of parotitis, and has ceased three weeks after that date, and probably earlier (a fortnight).

(4) The isolation of mumps presents no difficulty, and, even when it consists only in keeping the patient to his own room, is very commonly effective.

(5) Since a person about to suffer from mumps is not infectious until at most four days before the parotitis appears, it is possible, by isolating a person first seen ten days after his exposure to infection, to ensure that he shall not infect others; further, since the incubation period is most commonly nineteen to twenty-one days and is sometimes twenty-five days, it is well worth while to isolate a person who has been exposed to infection a fortnight or even three weeks earlier.

CASES.

Cases 1 *to* 6.

Communicated by Dr. W. H. Broadbent.

A boy (*Case* 1) at a school where an epidemic of mumps had begun on November 8, was removed from school on December 15; he had been specially exposed during the early part of the outbreak; the number of cases was greatest between December 14 and 19, four to six cases occurring daily. On January 2, when supposed to be safe, he was taken with his sister to stay with relatives at a distance, and on January 3, in the morning—nineteen days after cessation of exposure—symptoms of mumps were apparent, and he and his sister were sent home. On January 19 or 20 one of the cousins (*Case* 2), with whom he had been for a few hours on January 2, had mumps. On January 19 the sister of *Case* 1 (*Case* 3) had a stiff neck, and on January 21 unmistakably mumps. (*Case* 1 had been away from school nineteen days when mumps developed; *Case* 2 developed mumps seventeen or eighteen days after seeing the boy for a few hours; *Case* 3 developed the first symptoms of mumps sixteen days after her brother had parotitis.)

A girl, aged 15, and a boy, aged 12, who had been in the same house with another brother and sister suffering from mumps, were sent away from home together, and on January 21 arrived at the house of cousins in the country; but on January 22 the boy complained of a little discomfort in the neck, and on January 23 was sent home in a very early stage of mumps. On February 11, nineteen days after the departure of her brother, the sister (*Case* 4) he left behind, and on this day or the next, twenty-one or twenty-two days after commencement and nineteen or twenty after cessation of exposure, two cousins (*Cases* 5 and 6) were found to have mumps.

Cases 7 *to* 9.

Communicated by Dr. Fred. A. Best.

A child visiting at V.'s house was taken ill with mumps on March 8. A servant (*Case* 7) in V.'s house was taken ill on March 23 (fifteen days after the child), and Mrs. V. (*Case* 8) on March 24 (sixteen days after the child). A lady (*Case* 9) who visited the house on March 17 and left the same day, was taken ill on March 28 (eleven days after exposure). There were no other cases in the neighbourhood, nor in that to which the visitor went.

Cases 10 *to* 15.

Communicated by Mr. Lewin Hill.

A., staying in G.'s house, was, on January 3, found to have mumps. $B._1$, $B._2$, $B._3$ (*Cases* 10, 11, 12), who were staying in the same house, were separated from $A._1$ on January 3, and left G.'s house on January 5. $B._1$, $B._2$, and $B._3$ began with mumps February 6 to 8 (thirty-five to thirty-seven days after being separated from $A._1$, and thirty-two to thirty-four days after leaving G.'s house). $A._2$ had mumps "a few days" after January 16.

$C._1$ and $C._2$ (*Cases* 13 and 14), children of a third family not residing in G.'s house, spent the evening with $A._1$ on January 2—the day before

he was found to have mumps—and were also in company with $A._2$ on three or four occasions between January 3 and January 16. $C._1$ and $C._2$ had mumps February 6 to 8 (thirty-five to thirty-seven days after exposure to $A._1$, and an unstated period, but not less than twenty-one to twenty-three days, after being in the company of $A._2$).

D. (*Case* 15) spent the evening at C.'s house on February 2 (at least four days before $C._1$ or $C._2$ had mumps). D. had mumps on February 25 (twenty-three days after the visit to C.'s house).

Cases 16 *to* 26.

Communicated by Dr. C. E. Hoar.

Epidemic in a family. The first case, A., took ill on November 30, while the family were staying in lodgings, and had mumps on December 2, 1887; the mother (*Case* 16) remained with this child until December 8, when she returned home. She had mumps on December 18 (ten days after leaving A., sixteen days after A. had mumps, and eighteen days after A. began to sicken).

All the remaining members of the family were isolated from A. on December 2 (the day he first had mumps), and left the house in which he was on December 6. B. (*Case* 17) had mumps on December 18 (twelve days after leaving the house in which A. was, sixteen days after A. had mumps, and eighteen days after A. began to sicken). C. (*Case* 18) had mumps on December 20 (fourteen days after leaving house in which A. was, eighteen days after A. had mumps, and twenty after he began to sicken). D. (*Case* 19) had mumps on December 22 (sixteen days after leaving the house in which A. was, twenty after A. had mumps, and twenty-two after he began to sicken).

E. (*Case* 20), F. (*Case* 21), G. (*Case* 22), and H. (*Case* 23), who were in the same house as the mother, B., C., and D., but isolated, had mumps on January 6, 7, 7, and 8 respectively (nineteen, twenty, twenty, and twenty-one days respectively after the mother and B. began).

J. (*Case* 24), K. (*Case* 25), and the father (*Case* 26), left home on December 18, the day that the mother and B. began. J. and K. had mumps on January 8 (twenty-one days after leaving home), and the father on January 11 (twenty-four days after leaving home).

Cases 27 *to* 80.

Communicated by Dr. Clement Dukes.

C., residing at Mr. H.'s house at Rugby School, had mumps on October 17, 1873, and was at once removed to the sanatorium. $B._1$ (*Case* 27), P. (*Case* 28), and S. (*Case* 29), in the same house, had mumps on November 5 (nineteen days after C. was isolated), and $B._2$ (*Case* 30), in the same house, on November 6 (twenty days after C. was isolated).

W., in Mr. A.'s house, had mumps on October 14, 1873, and was removed to the sanatorium. T. (*Case* 31), in the same house, had mumps on November 1 (eighteen days after W. was isolated).

W., in Mr. M.'s house, had mumps on October 31, 1873, and was isolated. D. (*Case* 32), in the same house, had mumps on November 20, twenty days after W. was isolated.

F., in Mr. W.'s house, had mumps on November 2, 1873, and was isolated. The following cases followed in the same house:—L. (*Case* 33) on November 16, fourteen days after F. was isolated; H. (*Case* 34) on

November 18, sixteen days; P. (*Case* 35) on November 21, nineteen days after F. was isolated.

M., in Mr. E.'s house, had mumps on January 26, 1875, and was taken to the sanatorium. The boys who slept in the beds on either side of M. both had mumps—the one, D. (*Case* 36), on February 12, seventeen days after M. was isolated, the other, S. (*Case* 37), on February 14, nineteen days after M. was isolated.

R. maj., in Mr. A.'s house, had mumps on March 4, 1875, and was at once removed to the sanatorium. The following cases followed in the same house:

V. (*Case* 38)	sickened	March 21,	17 days	after R. maj. was isolated.
R. min. (*Case* 39)	,,	21,	17 ,,	,,
P. (*Case* 40)	,,	22,	18 ,,	,,
H. (*Case* 41)	,,	22,	18 ,,	,,
C. (*Case* 42)	,,	22,	18 ,,	,,
R. (*Case* 43)	,,	24,	20 ,,	,,
T. (*Case* 44)	,,	24,	20 ,,	,,

O., in Mr. B. S.'s house, had mumps on March 3, 1875, and was sent to the sanatorium. N. (*Case* 45), in the same house, had mumps on March 20, seventeen days after O. was isolated.

M., in Mr. H.'s house, had mumps on March 7, 1875, and was sent to sanatorium. H. and C. (*Cases* 46 and 47), in the same house, had mumps on March 25, eighteen days after M. was isolated.

E., in Mr. G.'s house, sickened with mumps on May 26, 1877, and was removed to the sanatorium. L. (*Case* 48), who shared the same study, sickened on June 20, twenty-five days after E. was isolated.

C. returned to school from home on January 24, 1878, and sickened with mumps on January 26, on which day he was taken to the sanatorium. U. (*Case* 49), in the same house, who had been with C. most of the time from January 24 to January 26, sickened on February 18, twenty-three days after C. was isolated and twenty-five days after C. had returned to school. C., who had been at Mr. V.'s private school, paid visits to it on January 24 and 25. B. maj. (*Case* 50), who saw C. at this (V.'s) school several times on the above-mentioned dates, sickened on February 14 and was reported with mumps on February 16, twenty-two days after last seeing C.

This B. maj., who was isolated on February 16, started an epidemic in Mr. V.'s school, the cases sickening as follows:

B. min. (*Case* 51), his brother, on March 3, 15 days after B. maj. was isolated.
C. min. (*Case* 52) on March 6, 11 days after B. maj. was isolated.

C. (*Case* 53)	,,	7,	19 ,,	,,
S. (*Case* 54)	,,	7,	19 ,,	,,

C., aged 14, at Mr. A.'s house, had mumps on March 10, 1878, and was sent to sanatorium. The following cases subsequently occurred in this house:

B. (*Case* 55)	sickened	on March 26,	16 days	after C. was isolated.
S. (*Case* 56)	,,	,, 29,	19 ,,	,,
L. (*Case* 57)	,,	April 3,	24 ,,	,,

M. developed mumps on May 10, 1878. His brother (*Case* 58), who went to another school on this day, developed mumps on May 29, nineteen days after last seeing M.

K., in Mr. E.'s house, had mumps on April 27, 1880, and was placed in the sanatorium. D. (*Case* 59), in the same house, had mumps on May 16, nineteen days after K. was isolated. C. (*Case* 60), in a different house, who sits two yards from K. in form, had mumps on May 14, seventeen days after K. was isolated.

A., in Mr. B.'s house, had mumps on February 15, 1880, and was removed to the sanatorium. R. (*Case* 61), also in Mr. B.'s house, had mumps on March 4, eighteen days after A. was isolated.

G., in Mr. S.'s house, had mumps on November 17, 1884, and was removed to the sanatorium on November 18. The following cases followed in this house:

K. (*Case* 62)	sickened on December	2, 15	days after G. began.	
M. (*Case* 63)	„	„	5, 18	„ „
$E._2$ (*Case* 64)	„	„	5, 18	„ „ Sits next B. at breakfast and tea; (parotitis on December 7).
$E._1$ (*Case* 65)	„	„	6, 19	days after G. began. Worked in same study as G.
K. maj. (*Case* 66)	„	„	7, 20	days after G. began. Was in sick-room with G. just before he was isolated on 18th.
M. B. (*Case* 67)	„	„	7, 20	days after G. began. Much with G.
B. (*Case* 68)	„	„	7, 20	days after G. began.
S. (*Case* 69)	„	„	8, 21	„ „ G. often in his study.
K. min. (*Case* 70)	„	„	11, 24	days after G. began. Sat next G. at preparation.

One other case (*Case* 71) occurred in another house, viz. W., in Mr. M.'s house, on December 6, nineteen days after G. began.

A. had mumps on March 9, 1885, and was removed to sanatorium. B. (*Case* 72), who resided in another house, but met A. in class, had mumps on March 30, twenty-one days after A. was isolated, and G. (*Case* 73), who also resided in another house, but sat behind A. in chapel, had mumps on March 31, twenty-two days after A. was isolated.

$B._1$, in Mr. B. S.'s house, had mumps on February 2, 1888, and was removed to the sanatorium. The following cases followed in this house:

$B._2$ (*Case* 74)	had mumps on February	19, 17	days after $B._1$ was isolated.	In same form and sat next but one at meals.
C. (*Case* 75)	„	„	19, 17	days after $B._1$ was isolated. In same dormitory with $B._1$.
N. (*Case* 76)	„	„	19, 17	days after $B._1$ was isolated. In same dormitory with $B._1$.
B. S. (*Case* 77)	„	„	22, 20	days after $B._1$ was isolated. Sits at same table with $B._1$.
G. (*Case* 78)	„	„	23, 21	days after $B._1$ was isolated.
R. (*Case* 79)	„	„	24, 22	„ „
C. *Case* 80)	„	„	24, 22	„ „

Cases 81 *and* 82.

Communicated by Dr. F. Adams Clarke.

Two children, girls (*Cases* 81 *and* 82), admitted to St. Pancras Schools, at Leavesden, on January 4, were examined then and found apparently healthy. They were, according to custom, quarantined for twenty-one days along with other children admitted on that day, and during this period could not have come into contact with mumps. On January 24 they were again examined and were apparently quite well, and on January 25 they passed into the body of the school. On January 28 both the children developed mumps, twenty-four days after leaving London for school.

Cases 83 *to* 86.

Communicated by Dr. C. W. Haig Brown.

The boys returned to a public school on January 24. On January 27 S., who had felt quite well on the previous day, complained of pain and swelling in the right parotid. D., F., W., and K. had been in class with him on January 26, but did not see him after 12.30 p.m. on that day. These four boys—D., F., W., K.—boarded in four different houses, and no one of them in the same house as S. They sickened as follows:

On February 14, D. (*Case* 83) complained of pain in right parotid at 6 p.m., and had swelling and fever next morning.

On February 15, F (*Case* 84) complained of swelling in right parotid at 3 p.m., having felt pain there for twelve hours.

On February 17, W. (*Case* 85) and K. (*Case* 86), had well-developed mumps. They had felt ill since the morning of February 16, but had not complained. Mumps developed in these cases on the following days:—

D.	F.	W.	K.	
20	21	23	23	after January 26, when exposure ceased.
22	23	25	25	,, 24, ,, began.

Case 87.

Communicated by Dr. Cayley.

Walter C., aged 14, returned home to Clifton from Marlborough College, where there was an epidemic of mumps, on April 8, 1878. On April 16 he was attacked by mumps, eight days after cessation of exposure to infection.

Case 88.

Communicated by Dr. F. Pearse.

The day before beginning to suffer from an attack of scarlet fever, and while feeling ill, the reporter visited a case of mumps. While convalescing from scarlet fever, and exactly eighteen days after the single visit to the case of mumps, he developed the first symptoms of mumps.

Cases 89 *to* 91.

Communicated by Dr. G. Birt.

A boy, F. G., aged 11, had a swollen face on May 17; he was first seen on May 18, when he had well-developed mumps, and was isolated

on that day. The following cases subsequently occurred in this family:

W. G. (*Case* 89), male, aged 19, showed mumps on June 1, thirteen days after isolation of F. G.

A. G. (*Case* 90), male, aged 13, showed mumps on June 2, fourteen days after isolation of F. G.

B. G. (*Case* 91), female, aged 17, showed mumps on June 5, seventeen days after isolation of F. G.

Cases 92 *to* 97.

Communicated by Dr. B. Duke.

On December 6, 1885, two members of the same family failed with mumps. Three other cases occurred in the family. Two (*Cases* 92 *and* 93) failed on December 24, and one (*Case* 94) on December 25, eighteen and nineteen days after December 6.

On December 9 a case of mumps occurred in a family. Three other cases (*Cases* 95 *to* 97) subsequently occurred in the same family, falling ill on December 25, 27, and 30 respectively (sixteen, eighteen, and twenty-one days respectively after the first case began).

Cases 98 *to* 120.

Communicated by Dr. A. Stedman.

Epidemic at St. John's Schools. The boys returned to school on September 14, 1887. The first case of mumps occurred on October 4, twenty days after. The second case occurred on October 18, fourteen days later. All the cases connected with the case on October 4 are shown in the following table, the numbers being the number of days after October 4:

			18			
	16		18			
	16	17	18	19		
	16	17	18	19		
	16	17	18	19		21
14	16	17	18	19	20	21
Case 98.	Cases 99 to 103.	Cases 103 to 107.	Cases 108 to 113.	Cases 114 to 117.	Case 118.	Cases 119 and 120.

Communicated by Dr. Chopinet, Médecin-Major, 83rd Reg. d'Inf., St. Gaudens, Haute Garonne.

In December, 1886, a small epidemic of mumps broke out in the garrison of St. Gaudens (Haute Garonne). It was strictly limited to the soldiers occupying four rooms in the barracks, two rooms on the second floor and two on the third. The first five cases occurred one after another in the same room, and in men occupying adjoining beds. The epidemic ceased in February, 1887. In May, 1888, a fresh epidemic broke out; it began in the same rooms as had furnished the cases in the earlier epidemic; seventeen men altogether were attacked during May, June, and July (when the attack ceased). The first eleven cases occurred in the four rooms above mentioned, and of the remaining six, four occurred in these rooms also. A single case occurred in December, 1888, also in one of these four rooms.

Cases 121 *to* 136.

Communicated by Dr. W. Squire.

A girl, aged 8 (*Case* 121), and a boy, aged 6¾ (*Case* 122), were exposed to infection on April 9. The girl had swelling of the parotid on April 23, the boy on April 25, fourteen and sixteen days respectively after the exposure. (*Temperature Observations on Children in Health and Disease*, London, 1887.)

A boy, aged 12 (*Case* 123, see Measles, Case 111), had measles-rash on March 30, ten days after leaving school. He had mumps on April 9, twenty days after leaving school. This boy was taken on March 30 to a house in which there were four children; these children (*Cases* 124 *to* 127) all had mumps from April 23 to 25. Here the interval between the appearance of mumps in the boy and the first of the four subsequent cases was fourteen days.

A boy, aged 8, attending a day school, who had not seemed very well for a week, had a stiff neck on March 20, 1870, and next day was febrile, and had parotitis. His next youngest brother and the nurse (*Cases* 128 *and* 129) had mumps on April 8 (nineteen days). Two sisters (*Cases* 130 *and* 131) sickened on April 9 and 10; the mother (*Case* 132) on April 12, and an infant, aged 1 year (*Case* 133), was febrile on April 12, and had enlarged parotid and submaxillary glands, with a temperature of 104·7° at night on April 14.

A boy was sent home on March 11, and was found to have mumps on the next day. A brother (*Case* 134) and a sister (*Case* 135) were separated from him on March 13, and sent away to different houses on March 14. The girl had stiff neck on March 25, and obvious mumps the next day—thirteen days after the separation. The boy was not well on April 2, was sent home on April 3, and had both parotids swollen on the next day, twenty-two days after the separation and twenty-one after leaving home.

A boy, aged 15 (*Case* 136), who had been associated at school with a school-fellow who "began with mumps" on December 16, returned home on December 17, where he was associated with five children. He left home on December 28, and on December 30 he had swelling of the right parotid. This was the first distinct symptom of mumps, though he had vomited on December 25, and had not looked well for the next few days. After a fortnight he returned home, but none of the five children took the disease.

(The above cases—123 to 136—are published in Dr. Squire's *Prevention of Infective Fevers*, London, 1887).

A. H., aged 15 (*Case* 137), at a public school, had mumps (face swelled) on March 12, during an epidemic at the school. He had metastasis on March 28, and was sent home a week later, three weeks after the mumps had begun; he was febrile, and had ulceration of the orifice of the upper salivary gland; yet a sister, older, and a brother, younger than himself did not contract the disease.

RUBEOLA.

IN German measles, as in measles, the attempt to calculate the length of the true period of incubation is often rendered uncertain by the occurrence of a primary or prodromal stage of very uncertain duration. In some cases the appearance of the rash is preceded by coryza, malaise, or actual fever lasting one, two, or three days or even longer (six, or ? seven days); in others these symptoms are either absent, or so slight as to escape observation. In calculating the latent period, therefore, it has been necessary to take the date of the appearance of the rash as the only available fixed date.

Incubation Period.

The number of cases received by the committee in which the disease is believed to have been contracted by a single short exposure to infection is small. They show so great a variation that a suspicion will at once arise that in the case of those which depart most widely from the average there may have been some exposure other than that to which infection was attributed.

Table I.—*Showing cases in which exposure was brief.*

No. of case.	Interval between exposure and First symptom.	Rash.
78	3	5
108	—	5
75	—	8
85	—	11
79	—	14
77	11	16
57	—	18
58	—	18
59	—	18
76	11	18
60	—	20

In four of the above ten cases the interval between the exposure and the appearance of the rash was eighteen days, and in six it was sixteen to twenty days. These cases, as far as they go, would tend to prove that the commonest date for the appearance of the rash was in the later part of the third week after exposure. Cases 85 and 79, however, show that the interval may be notably shorter, and in two of the cases with a longer period prodromal symptoms were noticed as early as the eleventh day.

Cases have been reported by Dr. Bristowe (108) and by Drs. Willcocks and Carpenter (75 and 78) in which the period of incubation is assumed to have been very much shorter, namely in one eight days from exposure to rash, and in two five days from exposure to rash. In the case with the longer period there were no prodromal symptoms, but in one of the others these lasted two days, so that the report requires us to assume that the true incubation period in this case was only three days. This patient was a nurse in a hospital in which a small epidemic affecting the staff was in progress; it seems far from impossible that she may have been infected by an earlier sufferer while he was in the prodromal stage. The other patient who sickened five days after exposure was also resident in a hospital. He was a young man who had never seen a case of German measles before, that is to say, wittingly. It is impossible therefore, to assert that either of these patients may not have been exposed to infection at some date earlier than that assigned; at the same time it ought to be added that there is no evidence in either case of any such exposure, and that some writers have put the incubation period of this disease at about a week.* Dr. Haig Brown, in the tabular statement which will be found at the end of the list of cases, states that a period of only six days was observed in 7 out of 75 cases in which it could be "computed fairly accurately," while in 3 more it was only seven days; in 31 altogether, it was ten days or less. On the other hand, in the statistics furnished by Dr. Clement Dukes from Rugby School, by Dr. Armstrong

* Dr. Pye-Smith states that the shortest period observed during an epidemic at Guy's Hospital in 1888 was eight days. Eustace Smith (*Diseases in Children*) writes that "the stage of incubation may last from one to three weeks." Louis Guinon, the author of the articles on the eruptive fevers in the *Traité de Médecine*, now (1892) in course of publication, writes:—"La rubéole est certainement celle des fièvres éruptives dont la période d'incubation est le plus mal connue." He adds that authority may be found for all dates from 5 to 22 days, and that MM. Bourneville and Bricon give 8 to 10 days.

from Wellington College, and by Dr. Stedman from St. John's Schools, Leatherhead, of school epidemics no such short periods appear. In all these cases, 69 in number, the infector was isolated as soon as the rash was perceived, but was associated with the boys infected down to that time; the period given is that from rash to rash, and assuming that the disease is infectious from the commencement of the primary stage, as is probably the case, this interval would coincide approximately with the true incubation stage. The shortest interval recorded by Dr. Clement Dukes is nine days, by Dr. Armstrong eleven days, and by Dr. Stedman twelve days. The relative frequency with which the rash appears on each day in this series of 69 cases is shown in the following table:

TABLE II.—*Showing the interval between cessation of exposure and appearance of rash ("rash to rash") in 69 cases occurring in certain school epidemics.*

Days	9	10	11	12	13	14	15	16	17	18	19	20	21
	56		70	3	23	4	6	18	45	39	36	13	106
				11	28	5	7	19	46	74	41		107
				40	64	16	8	20	49	99			
				54	72	17	30	21	50	100			
				61		25	31	33	97	101			
				62		29	32	34	98	102			
				63		65	52	35		103			
				71		66	67	38		104			
				93		73	68	43		105			
							69	44					
								47					
								48					
								94					
								95					
								96					

It appears, therefore, that even if we confine our attention to this series of cases, which does not show any exceptional periods, it will be necessary to admit that the incubation period varies very considerably, and that the rash is as likely to appear on the twelfth or fourteenth day as on the eighteenth. They, however, do lead to the conclusion that the period from the twelfth to the eighteenth day is that during which the rash is most likely to make its appearance. In more than half the cases in the above table the rash was first noticed on one of the first three days of the third week after the cessation of exposure.

Duration of Infectious Period.

The cases given below prove very conclusively that rubeola is infectious during the very earliest stage, resembling measles in this as in so many other points. Cases 57 to 60 reported by Dr. Railton are examples of infection derived from a child in whom the rash was just appearing; Case 77 is an example of a similar occurrence. In Cases 75 and 85 the exposure took place a short time before the appearance of the rash. The evidence of all the school cases is in the same direction; Dr. Clement Dukes' statement as to his experience at Rugby is very explicit—"Isolate as soon as you will, even on mere suspicion, without waiting for evidence, it will spread."

A patient probably ceases to be infectious as the rash fades, the only case which would cast any doubt on this assertion is Case 78; here the infection was supposed to have been derived from a patient whose rash had disappeared ten days earlier; as has already been pointed out, this case is exceptional in the short assigned duration of the incubation period; the concurrence of these two exceptional circumstances cannot fail to increase the suspicion that in this case there was some other source of infection.

In severe cases there may be, after the rash has disappeared, some roughness and branny desquamation of the skin; it has not been proved that this desquamation is capable of conveying the infection, but analogy seems to suggest some extra caution in these cases. Dr. Clement Dukes' rule probably meets the case well—isolation for a fortnight, followed by disinfection. In mild cases, in which category the great majority would be comprised, isolation for a week, followed by a bath, and disinfection of clothes, is probably amply sufficient, as Dr. Dukes' experience shows. At the same time it should be said that there is no evidence that the infection can be retained in clothes; and the absence of such evidence, taken together with the fact that the sufferer himself soon ceases to be infective, is strong evidence that the infective principle does not long retain vitality outside the human body, at any rate under ordinary circumstances.

Conclusions.

(1) The incubation period of rubeola is, as a rule to which there are many exceptions, some period more than two and

less than three weeks. Eighteen days is probably the usual period. In a considerable number of cases it is a day or two less than two weeks, in a few it is only eight or nine days, and it is possible that in a small number it may be as short as six or five.

(2) A susceptible person who has been exposed to the infection of rubeola may not develop the disease for twenty-one days, possibly even a day or two longer, and therefore, if it be desired to isolate such a person until all risk is passed, the period of quarantine should be two days more than three weeks.

(3) A patient who has contracted rubeola is capable of conveying the infection to others for two or three days before the rash has appeared, and also while the rash is out, but this capability rapidly declines, and has probably disappeared in a week in mild cases, and by the time desquamation is over in the more severe.

CASES.

Cases 1 *to* 56.*

Communicated by Dr. CLEMENT DUKES, Medical Officer to Rugby School.

No. of case.	Initial of patient.	Sex.	Age.	Date.	Residence.	Possible source of infection.	No. of days incubating.
				1877			
1	C.	Male	14	May 30	Mr. B.	—	—
2	P.	„	16	June 6	„	—	—
3	H.	„	15	„ 18	„	No. 2	12
4	N.	„	15	„ 20	„	„	14
5	C.	„	15	„ 20	„	„	14
6	J.	„	16	„ 21	„	No. 1 (?)	22
7	B.	„	14	„ 23	Mr. H.	No. 2 (?)	15
8	M.	„	15	July 8	„	No. 7	15
9	S.	„	18	June 20	Mr. A.	—	—
10	M.	„	14	„ 27	„	—	—
11	S.	„	17	July 9	„	No. 9 or 10	12 or 19
				1876			
12	F.	„	—	May 19	Mr. J.	—	—
13	H.	„	17	June 8	„	No. 12	20
				1878			
14	T.	„	14	May 27	Mr. H.	—	—
15	N.	„	16	„ 27	„	—	—
16	B.	„	15	June 10	„	No. 14	14
17	A.	„	16	„ 10	„	No. 15	14
18	T.	„	16	„ 12	„	No. 14	16
19	B.	„	15	„ 26	„	No. 16	16
20	H.	„	16	„ 26	„	„	16
21	P.	„	16	„ 26	„	„	16
22	F.	„	15	„ 15	Mr. E.	—	—
23	D.	„	15	„ 28	„	No. 22	13
24	G.	„	14	„ 17	Mr. J.	—	—
25	S.	„	14	July 1	„	No. 24	14
26	S.	„	15	June 12	Mr. A.	—	—
27	B.	„	16	„ 14	„	—	—
28	C.	„	13	„ 27	„	No. 26 or 27	13 or 15
29	B.	„	16	„ 28	„	„	14 or 16
30	F.	„	15	„ 29	„	„	15 or 17
31	G.	„	15	„ 29	„	„	15 or 17
32	B.	„	15	„ 29	„	„	15 or 17
33	H.	„	17	„ 30	„	„	16 or 18
34	F.	„	14	„ 30	„	„	16 or 18
35	C.	„	14	„ 30	„	„	16 or 18
36	J.	„	18	July 19	„	Probably (?)	19

* *Cases* 1 to 36 have been published in a paper in the *Lancet*, 1881, vol. i, p. 743.

No. of case.	Initial of patient.	Sex.	Age.	Date.	Residence.	Possible source of infection.	No. of days incubating.
				1882			
37	W.	Male	?	Feb. 28	Mr. J. B.	Fresh	Centre
38	G.	„	15	Mar. 16	„	No. 1	16
39	F.	„	15	„ 17	„	„	18
40	J.	„	15	„ 28	„	No. 2	12
41	B.	„	15	April 4	Mr. W.	No. 2 or 3	19 or 20
				1883			
42	S.	„	?	May 11	Mr. H.	Fresh	Centre
43	O.	„	„	„ 27	„	No. 6	16
44	R.	„	„	„ 27	Mr. L. W.	„	16
45	B.	„	„	„ 28	Mr. B. S.	„	17
46	C.	„	„	„ 28	Mr. H.	„	17
47	E.	„	„	June 12	Mr. L. W.	No. 8	16
48	D.	„	„	„ 12	„	„	16
49	C.	„	„	„ 13	Mr. S.	No. 7	17
50	H.	„	„	„ 13	Mr. E.	No. 8	17
				1887			
51	C.	„	„	Mar. 4	Mr. J. B.	Fresh	Centre
52	F.	„	„	„ 19	„	No. 15	15
53	O.	„	„	„ 7	„	Fresh	Centre
54	C.	„	„	„ 19	„	No. 17	12
55	C.	„	„	„ 10	„	Fresh	Centre
56	N.	„	„	„ 19	„	No. 19	9

Remarks.

Case 3 slept in bed next to *Case* 2.

Case 4 and *Case* 2 were great friends.

Case 5 and *Case* 2 were great friends, and were in the same study as *Case* 3.

Case 6 was in the same bedroom as *Case* 1; but the disease is so highly infectious he may have caught it by passing or speaking to *Case* 2—then it would be the fifteenth day.

Case 8 was in the same study as, and great friends with, *Case* 7.

Case 11 was in the same bedroom as *Case* 10, and great friends with *Case* 9.

Case 13 and *Case* 11 were the only two at the time.

Case 16 was in the next bed to *Case* 14.

Case 17 was in the same study as *Case* 15.

Case 12, brother to and in the same study as *Case* 14.

Case 19 was in the same study as *Case* 16.

Case 23 was in the same study as *Case* 22.

Case 25 was in the next bed to *Case* 24.

Case 38 saw *Case* 37 a few minutes prior to my removing him to hospital.

Case 39 was in *Case* 37's study with him on February 27, 1882.

Case 40 intimate with *Case* 38.

Case 41 was in the same form with *Cases* 38 and 39.
Case 43 was in the same bedroom with *Case* 42.
Cases 44 and 45 were in the same form with *Case* 42.
Case 46 was in the same study with *Case* 42.
Case 47 sat near *Case* 44 at dinner.
Case 48 was in same study with *Case* 44.
Case 49 was in same form with *Case* 43.
Case 50 was in same form with *Case* 44.
Case 52 did his work with *Case* 51.
Case 54 did his work with *Case* 53.
Case 56 was working with *Case* 55 just before he was isolated.

Omitting the cases which were fresh centres, sixteen in number, and omitting also Cases 6, 7, 11, 28 to 36, and 41, in which the source of infection was doubtful, there remain twenty-seven cases in which it could be named. In these twenty-seven cases it appears that the incubation period cannot have been less than—

9	days in	1 case
12	,,	3 cases
13	,,	1 case
14	,,	5 cases
15	,,	2 ,,
16	,,	9 ,,
17	,,	4 ,,
18	,,	1 case
20	,,	1 ,,

If the cases excluded above on the ground that the source of infection was doubtful be included in order to show the shortest periods possible in the various cases, as may fairly be done, then the following are the facts:

The incubation cannot have been less than—

9	days in	1 case
12	,,	4 cases
13	,,	2 ,,
14	,,	6 ,,
15	,,	7 ,,
16	,,	12 ,,
17	,,	4 ,,
18	,,	1 case
19	,,	2 cases
20	,,	1 case
		40

As to the period of infectiveness, Dr. Clement Dukes says:—"Isolate as soon as you will, even on mere suspicion, without waiting for evidence, it will spread." In mild cases he recommends the following course:—"After about three days in bed, followed by four days of fresh air, the patient is washed from head to foot with carbolic soap, his clothes are put through the disinfecting chamber, and he returns to school." In severe cases, however, Dr. Dukes notes that the "rash is followed by roughness of the skin. After isolation for fourteen days he is thoroughly disinfected and returns to school."

Cases 57 *to* 60.

Communicated by Dr. T. C. Railton, Manchester.

On December 31, 1888, a girl with the rash of rötheln just coming out upon her met four children—A., B., C., D.—among others at a small tea-party. Dr. Railton on January 19 saw A. and B. (*Cases* 57 and 58), who had not again met the girl above mentioned, with the rash and sore throat well marked; in both cases the rash had appeared on the day before (January 18, *i. e.* eighteen days after exposure). Dr. R. was informed that the rash came out on C. (*Case* 59) on January 18, and on D. (*Case* 60) on January 20. With reference to the diagnosis, Dr. R. states that both A. and B. had had measles within the year previous, and that the only symptoms during the attack of rötheln were rash, slight reddening and swelling of the fauces and edges of eyelids, and a very little branny desquamation.

Cases 61 *to* 74.

Communicated by Dr. H. G. Armstrong, Medical Officer of Wellington College.

On March 9 a boy in Mr. X.'s house was found to have German measles, and was isolated. Fresh cases occurred in this house, namely, three (*Cases* 61 to 63) on March 21, one (*Case* 64) on March 22, two (*Cases* 65 and 66) on March 23, and three (*Cases* 67 to 69) on March 24. Further, on March 12 a boy in Mr. Y.'s house was found to have the same disease, and was isolated. Fresh cases occurred in this house, namely, one (*Case* 70) on March 23, one (*Case* 71) on March 24, one (*Case* 72) on March 26, and one (*Case* 73) on March 27.

A case occurred at a third house on March 21, and on March 24 four other cases occurred in various other houses. If the cases in Mr. X.'s house on March 21 and subsequent days were due to infection by the case of March 9 in that house, then the duration of incubation was—

Not less than	12	days in	3 cases.
,,	13	,,	1 case.
,,	14	,,	2 cases.
,,	15	,,	3 ,,

If the cases occurring in Mr. Y.'s house were infected by the case occurring on March 12, then the period of incubation was, in the four cases occurring in that house subsequently, not less than eleven, twelve, thirteen, and fourteen days respectively.

Cases continued to occur up to and on March 28, when the school broke up; a large number of boys had the disease at home. One case (*Case* 74) was reported as having commenced on the eighteenth day.

Cases 75 *to* 84.*

Communicated by Drs. Frederick Willcocks and George Carpenter.

On January 20 Dr. A. M. (*Case* 75) saw a patient, Nurse A., suffering from malaise, who developed the rash of rötheln a few hours later. Dr. A. M. did not see the patient again. On January 28, without any

* Published in *Practitioner*, 1887 (vol. xxxix), p. 183.

definite prodromal symptoms, the rash came out on Dr. A. M., eight days from exposure to rash.

A clinical assistant (*Case* 76) saw Nurse A. on January 21, when her rash was fully developed. He had headache February 1 (eleven days), was indisposed with aching in back and limbs, coryza, &c., up to February 8, when rash appeared on face (eighteen days from exposure to rash).

Mr. A. L. (*Case* 77) sat with Dr. A. M. for three hours on January 28, when his rash was developing. On February 8 he had pain in back and hip, coryza on February 12, and rash on February 13 (sixteen days from exposure to rash).

Nurse P. (*Case* 78) saw *Case* 75 on February 9 for a few minutes, when he was supposed to be quite convalescent and his rash had disappeared for ten days. Nurse P. had headache and suffusion of eyes on February 12 and rash on February 14 (five days). Nurse P. was employed in the same hospital as Nurse A. and *Case* 76. Prodromal symptoms lasted for an unusually long period in *Case* 76, and some doubt may be felt whether Nurse P. may not have come into direct relation with *Case* 76 before the rash appeared, and while he was only suffering from indefinite symptoms—aching, anorexia, and slight catarrh.

Nurse M. (*Case* 79) went home on February 14 in good health. Her trunks were packed by Nurse P., who had at that time coryza but no rash. Nurse M. had rash on February 28 (fourteen days after exposure).

Case 80, sister of Nurse M. Rash appeared March 14 (fourteen days from rash to rash).

Case 81, servant to above and in attendance on them. Rash on March 16 (sixteen days after rash in *Case* 79).

Case 82, mother of 79 and 80. Rash on March 19 (nineteen days after rash in *Case* 79).

Case 83, sister of 79 and 80. Rash on April 1 (thirteen days after rash in *Case* 82).

Case 84, brother of 79, 80, and 83. Rash on April 19 (eighteen days after rash in *Case* 83).

Cases 85 *to* 92.

Communicated by Dr. W. Squire.*

Two children spent two or three hours on December 13 with a child who had the rash that evening. The elder (*Case* 85) became ill, and had the rash on December 24, eleven days after exposure. The younger (*Case* 86), who was not isolated from her sister, had a sore throat on January 3 and rash on January 4, eleven days after the rash came out on her sister.

A girl who attended a boarding-school as a day pupil had some spots on March 30, she had rash next day, and did not return to school. On April 12 another girl (*Case* 87) at the school had spots on her face (thirteen days) and the rash on the following day. Two other girls (*Cases* 88 and 89) had spots on April 13 (fourteen days), one (*Case* 90) on April 14 (fifteen days), one (*Case* 91) on April 15 (sixteen days), and one (*Case* 92) on April 16 (seventeen days).

* These cases were published by Dr. Squire in his *Prevention of Infective Fevers*, London, 1887.

Cases 93 *to* 107.

Communicated by Dr. Arthur Stedman, Medical Officer to St. John's Schools, Leatherhead.

The first two cases of an epidemic occurred on June 3, and the next cases were noted on the following dates:

1 case on	June 15,	12 days	after the first 2 cases	(*Case* 93).
3 cases	„ 19, 16	„	„	(*Cases* 94 to 96).
2 „	„ 20, 17	„	„	(*Cases* 97 and 98).
7 „	„ 21, 18	„	„	(*Cases* 99 to 105).
2 „	„ 23, 21	„	„	(*Cases* 106 and 107).

Cases also occurred on June 26 and 28 and on July 3, 5, 9, but the source of infection in these is, obviously, doubtful, since there was a case in the school on June 15, thirteen days earlier.

Case 108.

Communicated by Dr. J. S. Bristowe, F.R.S.

During an outbreak of German measles at Westminster School, Dr. Bristowe took a young medical man, X., at that time holding a resident appointment in St. Thomas's Hospital, to the school to see some of the cases. X. had never seen the disease before. Five days afterwards he was attacked with genuine but rather severe German measles. There were neither then nor afterwards any cases of this disease in or about the hospital.

Communicated by Dr. C. W. Haig Brown, Medical Officer of Charterhouse School, Godalming.

The period of incubation could be "computed fairly accurately in 75 cases" out of 202.

In 7 cases	it was 6 days.	In 10 cases	it was 12 days.
„ 3 „	7 „	„ 6 „	13 „
„ 1 case „	8 „	„ 11 „	14 „
„ 10 cases „	9 „	„ 5 „	15 „
„ 11 „	10 „	„ 2 „	16 „
„ 18 „	11 „	„ 2 „	17 „

SCARLET FEVER.

THE opinions held by various writers as to the duration of the period of incubation in scarlet fever have been conflicting. Dr. Murchison, in the paper on the subject of incubation to which reference has already so frequently been made, collected, from a score of authors, estimates ranging from one day to one month. The examination of the large number of cases received by the Committee will show that, while the evidence for the shorter of these periods is very strong, there is none of a trustworthy sort to support the opinion that the incubation period can be extended beyond a week, or at most eight days.

Incubation Period.

In Table I, have been collected the cases in which the disease followed at a known interval an exposure for a short time to a known source of infection. The Table contains 34 cases, and in 28 of these the time of onset of the earliest symptoms is stated. This interval was :

In 10 cases	. . .	2 days or less.
„ 6 „	. . .	More than 2, but not more than 3 days.
„ 5 „	. . .	„ 3, „ „ 4 „
„ 3 „	. . .	„ 4, „ „ 5 „
„ 1 case	. . .	6 days.
„ 2 cases	. . .	7 „
„ 1 case	. . .	8 „

More than half the cases, therefore, show an incubation period of three days or less, and only four a period of more than five days. For the discussion of the relative frequency of short as compared with long periods of incubation, however, it will be proper to include the cases in which the date of the appearance of the rash only is given, since the true period of incubation in these cases must have been some period less than that which intervened between the exposure

and the appearance of the rash, if indeed in certain cases the two periods did not coincide, approximately.

Adding these cases, it will be found that:

2	cases	were attacked	during the *first*	twenty-four hours.
10	,,	,,	*second*	,,
7	,,	,,	*third*	,,
6	,,	,,	*fourth*	,,
4	,,	,,	*fifth*	,,
2	,,	,,	*sixth*	,,
2	,,	,,	*seventh*	,,
1	,,	,,	*eighth*	,,

In a large number of cases the date at which exposure to infection commenced is known, but the exposure continued until the onset of the disease in the person thus infected. Obviously cases of this kind do not possess any value for the determination of long periods of incubation, but they may afford evidence as to the occurrence of unusually short periods. An examination of Table II, in which the cases of this order have been brought together, will show a considerable number of instances in which the period of incubation must have been short. It is difficult without understating the case for a short period of incubation, to give any numerical summary of this Table; in many of the instances in which the period was six to eight days it is easy to see from a perusal of the reports that there may have been circumstances which caused a postponement of infection for several days. Isolation, even though the patient is in the same house, is often effectual during the acute stage while the patient is confined to bed, but fails as soon as convalescence sets in, when it becomes very difficult to keep apart children who reside in the same house and have been accustomed to unrestricted intercourse. The numerical summary of the cases is as follows:

3	cases	were attacked	during the *first*	twenty-four hours.
13	,,	,,	*second*	,,
17	,,	,,	*third*	,,
12	,,	,,	*fourth*	,,
6	,,	,,	*fifth*	,,
10	,,	,,	*sixth*	,,
7	,,	,,	*seventh*	,,
4	,,	,,	*eighth*	,,

If the cases in Table I and Table II be taken together,

we have 106 cases in which the interval between the only exposure, or the commencement of exposure and the onset of the disease is known; that is to say, in these cases the period of incubation, if the facts be accepted, cannot have exceeded the intervals named. The following summary shows the length of time, after the earliest or only exposure, at which the patients were attacked, or were found to be suffering from the early stage of scarlet-fever rash:

5	cases were attacked during the		*first*	twenty-four hours.
23	,,	,,	*second*	,,
24	,,	,,	*third*	,,
18	,,	,,	*fourth*	,,
10	,,	,,	*fifth*	,,
12	,,	,,	*sixth*	,,
9	,,	,,	*seventh*	,,
5	,,	,,	*eighth*	,,

The five cases in which the onset of the disease followed within twenty-four hours the commencement of exposure to infection are Cases 26, 31, and 91, and i, and ii, in Dr. Murchison's list. Case 91 was a child admitted into a children's hospital for a scald of the back, and it was believed that all sources of infection outside the hospital, in which there had been, in the same ward, a case of scarlet fever rather more than a month earlier, had been excluded. In Case 31 it is no doubt difficult to feel absolute certainty that there had been no previous undiscovered communication between the two families, who were related. To the three other cases there does not appear to be any obvious objection. Taken as a whole, the cases will afford strong support to the opinion held by Trousseau and others, that the onset of scarlet fever may teke place within twenty-four hours of the exposure to infection.*

* Trousseau's case is recorded by him in his *Clinical Medicine* (New Sydenham Society's translation, vol. ii, pp. 165, 166. There is a misprint of days for hours in the translation). An English girl, who had passed the winter at Pau, went to Paris with her father early in 1859. In Paris she met her elder sister, who had travelled direct from London, where scarlet fever was epidemic. This sister was seized with fever and sore throat when crossing the Channel, and arrived in Paris, seven or eight hours later, in the middle of a very serious attack of scarlet fever. The two sisters arrived at the Paris hotel almost at the same moment. The younger showed the first symptoms of a mild attack of scarlet fever in twenty-four hours. There were no cases in Pau. "This curious history," Trousseau observes, "proves that in scarlet fever the duration of the period of incubation is sometimes not more than twenty-four hours. I am, how-

While affording evidence of the occasional occurrence of a period of only twenty-four hours, the cases are, as will be seen, very far from indicating that this is an ordinary or frequent period. They tend to prove that some period between twenty-four and seventy-two hours is the most common incubation period of scarlet fever.

To the 106 above mentioned may be added four cases contained in Table IV, in which the date at which the exposure to infection began is known. The 110 cases thus obtained have been arranged in Table III, which affords a diagrammatic representation of the relative frequency with which the onset of scarlet fever occurred in the series of cases, on each of the days from one to eight. Cases in which the exposure to infection was for a longer period have not been included, since they cannot throw any light on the period of incubation. The general error in this table is to overstate the probable length of the incubation period, but even so it shows that two, three, and four days are the commonest intervals between the commencement of exposure to infection and the onset of symptoms. Table I, taken by itself, gives a result which corresponds very fairly with that shown by Table III, but makes the commonest incubation period a little shorter, as might be expected *a priori*. Nor does this exhaust the evidence in favour of the opinion that the customary incubation period of scarlet fever is something less than four days. Appeal may be made (1) to the remarkable epidemic on ship-board reported to Dr. Murchison by Dr. J. Hogarth Pringle

ever, very far from believing that that is its ordinary duration." Thomas (Ziemssen's *Cyclopædia*, vol. ii, p. 167, English translation) mentions a case reported by Russegger as an example of an incubation period of less than twenty-four hours. The facts, which are not fully given by Thomas, are as follows (*Œst. m. Jb.*, 1848, 63 Bd., p. 282):—An epidemic of scarlet fever started in Kitzhübel in July; it appeared in Jochberg towards the end of July. A child in Jochberg visited a child with scarlet fever at noon; it became hot that evening, and early next day scarlet fever appeared. The date of the case quoted is not given, so that there is no certainty that it did not occur during the epidemic in Jochberg. Rehn's case (*Jrhbch. f. Khde.*, 1869, p. 439), also quoted by Thomas, is very inconclusive; he merely thinks it probable that the incubation period may have been twenty-four hours because the grandmother, who apparently carried the infection in her clothes, came into more intimate relation with the child about that time before the onset of symptoms, but she had been in the same house for twenty-four hours longer. The grandmother, who had been nursing a scarlatinous patient at Stuttgart, returned to Hanau, where there was no scarlet fever, on April 29th, and then came in contact with her grandchild, aged 4¼. The grandmother slept with the children the night of April 30th—May 1st. The child had shivering, headache, &c., on May 1st about midday, and the rash on May 2nd. "Die incubation kann demnach hier höchstens 48 Stunden, wird aber wahrscheinlich kaum 24 Stunden betragen haben."

(see Cases xxv to liv* below); (2) to the epidemic at Upwell, laconically described in the extract from the school log-book given by Dr. Page (see paragraph following the description of Cases 97 and 98); and (3) to the outbreak following the festival in honour of William III, described by Dr. Blaxall (page 163). In both of these last-mentioned epidemics a large number of cases followed, within four or five days, occasions of public assembly at which many children were present.

While it is desirable to ascertain the shortest, and the customary periods of incubation in scarlet fever, it is perhaps of more practical consequence to learn the maximum length of the period of incubation. Certain authors have supposed that the latent period may be extended to ten days, a fortnight, or even a month.†

The evidence on this head which has been placed at the disposal of the Committee is to be derived from certain cases in Tables I, and IV; they are, however, significantly few in number; indeed, if seven days be accepted as the limit beyond which a case is to be considered exceptional, then only two cases—two cases, that is to say, out of a total of fifty-nine, will fall into this category. If the circumstances under which these cases occurred prove on examination to be of a kind to eliminate all sources of fallacy, it would of course be necessary to accept their evidence, since one positive observation of the kind would outweigh the negative evidence of other observers; on the other hand, if the evidence in these cases is not conclusive, the fact that they are exceptional in the assigned length of the period of incubation would strengthen any doubts which might be raised by other circumstances. The two cases are Cases 62 and 75; as to the latter it may be observed that the child was a patient in a children's hospital, and it is well known that in such institutions it is exceedingly

* Roman numerals refer to Dr. Murchison's cases.

† The following are given by Murchison:—(1) Niemeyer (*Text-book of Practical Medicine*, Amer. trans., 1869, vol. ii, p. 533), eight or nine days. (2) R. Williams (*On Morbid Poisons*, 1836) and W. Aitken, a few hours to ten days. (3) Reinhold (Ziemssen's *Cyclopædia*, Amer. trans., vol. ii, p. 169), eleven days. (4) Bathurst Woodman (*Lond. Med. Journ.*, Feb., 1865, p. 76), two to fourteen days. (5) Böning (Ziemssen, loc. cit.), fourteen days. (6) Copland (*Med. Dict.*, vol. ii, p. 354), one to twenty-five days. (7) Maton (*Trans. Col. Phys.*, vol. v, p. 149), twenty-six days; but Murchison finds, on reference to the original paper, that it is "very doubtful" whether the cases were scarlet fever at all. (8) Most (*Gesch. des Scharlachf.*, ii, 178), one month. To this list may be added Dr. Lewis Smith, who, in Pepper's *System* (vol. i, p. 493), gives a case which is held to point to a period of twelve days (but the patient remained in the same house as the person infected).

difficult to ensure that the children are not infected by friends who come to visit them from homes in which infectious diseases are often present, a fact apt to be concealed from the authorities of the hospital, especially if subsequent events lead to special enquiries being made. The other case is very briefly related, no dates are given, and it is not stated that the case was observed by the reporter himself. In discussing such cases two facts must be borne constantly in mind, namely, the ease with which the infective agent in scarlet fever can be preserved and carried in fomites, and the circumstance that the disease is sometimes, especially in adults, of so mild and anomalous a character that the patients do not apply for medical treatment, or the nature of their illness is not recognised.

It is interesting to note that Dr. Murchison considered a case recorded by Dr. Squire, in which no symptoms were observed, though looked for with care, until the eighth day after the child had been removed from the infected house, as "about the best instance of long incubation-period in scarlatina" with which he was acquainted. In a communication, however, addressed to the Committee (under date April 4, 1892) Dr. Squire writes with reference to this case :—"Subsequent experience has made me doubt this single instance of an eight days incubation of scarlet fever; and there was communication between the infected house and the child in quarantine. The distance between the houses was not great, and things were sent from one to the other." This fully confirms Dr. Murchison's suspicion expressed in 1878, that in such cases some fallacy lurks.

On the whole, therefore, it would seem that the large number of cases collected by the Committee do not afford any instances which prove that the latent period in scarlet fever ever exceeds seven days.

The general conclusion is thus practically identical with that reached by Dr. Murchison, who wrote* with reference to the alleged occurrence of long periods of incubation :—"I may add that during many years it has been my practice to pronounce persons, who had been exposed to the infection of scarlet fever, safe after a quarantine of seven days, provided their clothing had been properly disinfected; and that so far I have seen no reason to alter this rule." To this should be added the further proviso that the throat should be examined

* *Transactions*, loc. cit.

carefully, and that the existence of sore throat should be regarded with the greatest suspicion.

Milk.

The cases in which infection was derived from the ingestion of contaminated milk form a very interesting group, which appear to be deserving of separate consideration. In some there is good reason to believe that we are in possession of all the facts necessary to enable us to ascertain the period of incubation with the utmost precision. The cases have been collected in Table V, which is divided into three parts, according as the ingestion of the milk in question took place on a single occasion only, began at a known date, or ceased at a known date. There are eleven cases in the first division, and it will be seen that in none did the interval between the ingestion of the milk and the full development of the disease exceed five days, that in seven it did not exceed forty-eight hours, that in four it was about thirty-six hours, and that in two it was only thirty hours; the true incubation period, that is the interval between the ingestion of the milk and the onset of the earliest signs of illness, did not in any case in which it was ascertained exceed two days. In nine cases the date at which the use of the contaminated milk was commenced is known; in all of these (with the exception of one in which it was not noticed at all) the rash came out within four days, and in none could the true period of incubation have exceeded three days. In three cases the use of the milk ceased at a known date, and all the patients had scarlet fever within two days.

It must be admitted, therefore, that these cases point to a short period of incubation; further, it will be seen from a perusal of the reports that the evidence they afford is a good deal more voluminous than would appear merely from an inspection of Table V. In a very large number of cases, though the precise dates could not be given, the limit of time within which all the cases traceable to a particular contaminated milk occurred, could be stated. For instance, in the epidemic following the use of certain cream at a dinner-party (see below the reports by Sir George Buchanan and Dr. Murchison), all the eighteen cases (twelve of scarlet fever and six of sore throat) occurred between the second and the fifth days thereafter. In the Fallowfield outbreak (see below abstract of Dr. Airy's report, page 171) the last case of

scarlet fever occurred five days after the contamination of the milk may have begun, and only three days after such contamination was at its maximum. Two cases of sore throat occurred later, but the whole outbreak in its relation to the milk supply was over seven days after the commencement of the specific pollution of the milk, and five after this was at its maximum. The Wimbledon epidemic (see p. 173) also affords evidence of a striking kind as to the occurrence of short periods of incubation, and also, though of a less conclusive character, against the occurrence of long periods. The main epidemic was traced to the use of milk supplied by a particular dairyman; the sale of the milk was stopped, and within forty-eight hours the number of cases showed an immense decrease; in all probability the epidemic was completely arrested so far as it was due to his milk, but as cases had been occurring for five days before the sale was stopped, the mode of infection could not be traced with certainty in every instance. This dairyman, when he was prevented from continuing the sale of his milk, sold two of his cows to a neighbour, who combined with the trade of a butcher that of a milkseller. On the second day after this sale of the cows cases of scarlet fever began to occur among the butcher-milkman's customers, but the chief incidence on them was on the third day, when ten out of the total of twenty-four cases were attacked.

Unrecognised cases.

Reference has already been made to the occurrence of cases of so mild a character that the patients do not come under medical treatment, or so anomalous that the true nature of the disorder is not recognised. A most striking instance of this is the case of Dr. Murchison himself (Case 23). In Case 65 infection was derived from a girl who was suffering from a sore throat, the specific nature of which was not recognised, though she had been staying in a house in which scarlet fever was prevalent. Dr. Page gives an account (see Cases 99 and 100) of an epidemic started in a village by a young man who was treated for "ulcerated sore throat." Dr. Parson's report, an extract from which will be found at page 162, gives another instance of the occurrence of unrecognised cases of scarlet fever supposed to be "simple sore throat." Examples of such confusion might easily be multiplied, but instances are probably within the experience of

everyone. Dr. Squire has communicated a case in which a schoolboy who, when his school was broken up on account of scarlet fever, was allowed to return home, though he had a sore throat. His mother sickened with scarlet fever three days later, and other cases subsequently occurred in the family.*

Scarlet fever sometimes leaves a special liability to sore throat; it would be important to ascertain whether, as seems to be the case in diphtheria, patients suffering from these recurrent attacks of throat illness are capable of infecting others with scarlet fever. Dr. Squire gives one case in which this seems to have occurred, but the data at hand are too scanty to allow any conclusions to be drawn here.

In the reports of epidemics due to drinking specifically polluted milk, it will be found that mention is made of cases of sore throat, and more rarely of severe diarrhœa, occurring in relation with the infection of scarlet fever. It has been remarked in some of these epidemics that there was remarkably little evidence of extension by personal intercourse, still there can be no doubt that these cases of sore throat which are produced by exposure to infection of scarlet fever are capable of producing the disease. As to the power to convey the infection of scarlet fever of those anomalous cases in which diarrhœa is the only symptom, the reports communicated to the Committee do not afford any positive conclusions; some such cases, which at first present only symptoms referable to the gastro-intestinal tract, subsequently develop a characteristic rash. It would seem, therefore, that the prudent course would be to regard all cases of severe diarrhœa and vomiting occurring in relation with cases of scarlet fever as possibly due to the same infection, and as calling for the same precautions as to isolation and disinfection as those in which the rash is clearly developed.

* Dr. Francis Bond has recorded a case (*Brit. Med. Journ.*, 1882, vol. ii, p. 560) which illustrates this point so well that it may be convenient to quote it here:—A lad, aged 17, who had had scarlet fever a year before, was sent home from a school where scarlet fever had broken out. He was not allowed to enter the house until he had had a carbolic bath in an outhouse, and had put on old clothes sent from the house on purpose, and had been taken for a long walk. He was then allowed to enter his father's house, taking with him absolutely nothing he had brought from school except a pocket-book. In a "few days" one of the other children had scarlet fever, and the others all followed. Dr. Bond subsequently ascertained that the boy had *a sore throat* a day or two before he was sent home, and on examining the throat—nearly three weeks afterwards—he detected traces of slight congestion there. Dr. Bond attributes the infection of the other children to the throat affection.

Fomites.

Scarlet fever is easily, and probably very frequently, carried by fomites. Examples of infection by clothes and other fomites are afforded by Cases 20, 21, 71, 72, 73, 101, 102, 103, 104, iv, and the interesting series given by Dr. Murchison (xxv to liv). In the last-mentioned series, thirty cases occurred on shipboard within four days after some clothes which had been packed up three months before in an infected house were unpacked and taken into use. In the case of a woman who slept in a bed occupied on the previous night by a child suffering from the disease, the period of incubation was short, two days. In the four cases observed by Dr. Tonge-Smith, in which persons were infected by travelling in an ambulance used for transporting cases of scarlet fever, the period of incubation varied from two days and a half to three days."

Though the fact that scarlet fever can be conveyed by fomites is well known, it is probable that it has not always been borne in mind by writers who have assigned unusually long periods of incubation. Hildenbrand is said to have caught scarlet fever from his own cloak, which, after exposure to the poison, had been locked up for eighteen months. "It has been well remarked," says Dr. Murchison, "that had he put on this cloak at the end of one, instead of at the end of eighteen months, after visiting the patient who infected the cloak, and been then attacked, the case would have been quoted as one proving the possibility of the incubation-period extending over four weeks."

Dead bodies.—The infection can be caught by paying a visit to a house in which a patient has died in order to see the body. One such instance is quoted from Dr. Blaxall.

Conveyance of infection by persons who did not suffer.

The cases afford a few instances also of infection carried by persons who did not themselves suffer from the disease. In one case the carrier of the infection, after visiting a patient on the fourth day of the illness, while the rash was profuse (Case 26), walked across some fields and then came into close contact with a boy aged eight or nine, who began to be ill twenty-four hours afterwards. In another instance (Case 100) the infection appears to have been carried to an isolated farm-house by a young schoolmistress who went to reside there

when the school in which she taught was closed on account of an epidemic. In two cases recorded by Dr. Murchison (Cases lxxiii and lxxiv) the disease seems to have been contracted through a girl who had visited an infected house but did not herself suffer from the disease. In a case reported by Dr. Parsons (Case 94) it is possible that infection was conveyed in a similar manner.

It is probable that these cases are all essentially instances of conveyance of infection by fomites, but, as has been already observed, an epidemic may be started by a person who after exposure to the infection of scarlet fever has suffered only from sore throat.

Duration of Period of Infectiousness.

The cases in which infection was derived from a patient in an early stage have been brought together in Table VI. They are few in number, and in none is it necessary to suppose that the infection was caught until the patient was suffering from marked but perhaps indefinite symptoms of illness, or was within a few hours of showing the rash. Dr. Blaxall* mentions an epidemic in a village school, which was probably started by children who attended while in the incubation-stage, but these children did not leave until they were "ill with scarlatina." On the whole the cases support the opinion that while scarlet fever has an infecting power from the earliest stage of the malady, yet, to quote an additional argument from Dr. Murchison,† "the comparative facility of preventing its spread in a school points to this power being much less during the first two or three days than in the case of measles."

The contrast in the behaviour of these two diseases is continued at the opposite extreme of their course, for a patient who has suffered from scarlet fever is infectious long after convalescence has been completely established. Cases bearing on this point are shown in Table VII. In some of these instances the theory that infection was due to fomites may be accepted without much hesitation; but in others, in those, namely, in which the patients had been inmates, sometimes for as long as six or seven weeks, of well-appointed hospitals specially devoted to the treatment of infectious diseases, this hardly appears tenable. In one of Dr. Murchison's cases

* See below, abstract of Report on Scarlet Fever in Lower Brixham (p. 162).
† *Transactions*, loc. cit.

(xxiv) it would appear that the infection could not have been derived from fomites, and that the occurrence of a tardy desquamation, after this process had already twice taken place, was the source from which infection was derived. The longest period mentioned in any instance is in a very similar case (58). The infector was undergoing a second desquamation of the feet eight weeks after the beginning of her attack of scarlet fever. In the majority of the cases, however, the condition of the convalescent person who infected others is not stated with sufficient precision or fulness to warrant us in drawing any conclusions as to the mode in which the infection was preserved for these long periods. In is, however, well shown that the mere efflux of time cannot be trusted, and that a patient who is completely convalescent—so far, at any rate, as would appear on a cursory examination—may yet be, in some way, capable of infecting others. The facts observed in some cases render it probable that a minute examination might in all have revealed some pathological condition which would have accounted for the persistence of infection.

Scarlet Fever in relation with the Puerperal State, and with Traumatism.

The only cases throwing any light on the relation of scarlatina to the puerperal state are those communicated by Dr. Boxall, and already published by him elsewhere. They are of two orders: in the one the patient was exposed to infection during or immediately after labour; in no one of these three cases can the period of incubation have exceeded seventy-two hours, and the author observes that it seems possible that when infection takes place during or shortly after labour, the incubation-period may be shortened. In the other set of cases the women had been exposed to, in some instances had been in close contact with, patients for various periods before delivery; these women were attacked from two and a half to about five days after delivery, but from a month to a week after the beginning of exposure. In all the cases the exposure was continuous up to the time of the admission of the woman in labour into a lying-in hospital, and in two of the cases it appears to be impossible to come to any other conclusion than that labour in some way determined the onset of scarlet fever, or rather was the determin-

ing cause that the woman took scarlet fever at all (Cases 138, 139).

The cases illustrating the relation of scarlatina to traumatism are also few in number, consisting only of those sent by Mr. Scott Battams, formerly Resident Medical Officer of the East London Hospital for Children, Shadwell. The cases are too few to warrant any conclusions being drawn from them, but it will be noticed that the cases of scald show very short periods of incubation. The two cases in which the operation for cleft palate was performed appear to be examples of the influence of traumatism in determining the onset of scarlet fever (see table appended to cases, page 161).

Conclusions.

(1) The incubation-period of scarlet fever is usually some period between twenty-four and seventy-two hours; it is occasionally less than twenty-four hours, frequently more than the longer limit above mentioned. Periods of four, five, and six days are often to be met with, and of seven days occasionally, but it is very doubtful whether the period of incubation is ever extended to eight days.

(2) Scarlet fever is infectious from the onset of the earliest symptoms, and until long after convalescence has been established. Infection certainly persists as long as there is any desquamation, and may still be active eight weeks after the onset of the disease.

(3) The infection of scarlet fever is readily preserved in and conveyed by fomites.

(4) The symptoms of scarlet fever may be very anomalous or very little marked, and, especially in the adult, may consist only of sore throat.

(5) A person who has been exposed to the infection of scarlet fever, if at the end of seven clear days he is free from fever and from sore throat, and does not show any signs of illness, may, after disinfection of his clothes and other fomites, be pronounced safe.

(6) There is no proof that the period of incubation is shorter or longer in persons who have met with an injury, nor in women who have recently been delivered, but there are grounds for believing that the occurrence of labour or of traumatism may determine the onset of scarlet fever in persons who had previously been exposed to infection without taking the disease.

TABLE I.—*Cases in which there was exposure for a short known period.*

No.	Age of person infected.	Mode of infection.	Interval to	
			First symptoms.	Rash.
26	8 or 9	Mediate	24 hours	30 hours
iii	Child	Visited a house in which was a patient	26 to 30 hours	—
31	9	Visited a patient	1 day	About 30 hours
57	20	Visited a convalescing patient	—	36 hours
vi	11	Visited a house in which there were patients	36 hours	—
xi	4½	Stood close to a patient for two hours	36 to 40 hours	48 hours
54	3	Played with a patient	—	2 days
xii	30	Contact for ten minutes	36 to 41 hours	60 hours
20	Adult	Slept in bed occupied by a patient on previous night	Less than 48 hours	„
24	8	Played four hours with three patients	„	„
97	Child	Contact with patients or convalescents	2 days	—
115	„	Personal communication	„	4 days
101	—	Scarlet fever ambulance	60 hours	—
104	—	„ „	64 hours	—
103	—	„ „	—	72 hours
102	—	„ „	72 hours	—
105	—	Contact with convalescents in a public conveyance	„	—
xx	22	Kissed a slight case	3 days	3 days and a few hours
94	Child	Mediate	„	—
25	Adult	Visited room in which patients were	76 hours	84 hours
58	19	Slept with desquamating convalescent	—	4 days
28	Adult	Visited a patient	4 days	5 days
30	5	Nursed by a patient with rash	„	„
xxii	4	Played with a sickening child	„	„
98	Adult	Personal contact with patients or convalescents	„	—
55	2	Short contact with infected child	—	5 days
lv	44	Contact with patient; food from infected house	4½ days	5½ days
27	Adult	Visited house of convalescents	5 days	—
10	„	Visited a patient; second attack	„	7 days
74	Child	Contact with a patient; first day	—	6 days
29	Adult	Visited a patient with sore throat; day before rash	6 days	—
83	8	Contact with patient	7 days	—
21	Adult	Clothes	„	—
75	Child	In next cot to patient; first day	8 days	9 days

TABLE II.—*Containing cases in which exposure began at a known date, showing interval between commencement of exposure to infection and the onset of the disease.*

No. of case.	Interval from commencement of exposure to		
	First symptoms.	Rash.	
i	18 hours	Less than 36 hours	Nursed a sister suffering from severe attack.
ii	24 hours	—	Nursed a patient in early stage.
91	—	1 day	Followed a scald of back.
iv	30 hours	—	After operation; attended by a nurse from a scarlet fever case.
v	36 hours	—	Went as servant to infected house.
vii	„	—	Nursed her son, who had malignant scarlet fever.
xiii (D)	„	—	? Fomites.
89	—	2 days	Followed a scald of chest.
93	—	„	Followed scalds.
42	48 hours	—	Admitted in error to a scarlet fever ward.
xiv	„	—	Infected by convalescent brother.
xv	„	—	Nurse in scarlet fever ward.
xvi	„	—	Stayed in an infected hotel.
63	„	54 hours	Admitted in error to a scarlet fever ward.
11	„	60 hours	Child infected by her nurse, who did not suffer.
113	2 days	—	Boy infected by convalescent sister.
1	52 hours	60 hours	Child infected by convalescent brother.
xviii	2½ days	3 days	Nursed a child "badly ill" with scarlet fever.
107	64 hours	72 hours	Admitted in error into scarlet fever ward.
4	69 hours	—	Acted as sick nurse to her sister.
108	72 hours	—	Nurse in scarlet fever ward.
106	70 hours	74 hours	Admitted in error into scarlet fever ward.
90	—	3 days	Followed burn of face.
92	—	„	Followed a burn or scald.
2	72 hours	84 hours	Child infected by convalescent sister.
3	„	„	Ditto.
5	„	—	Boarder in school in which there had been scarlet fever recently.
32	3 days	—	Infected by convalescent patients.
xix	„	4 days	Returned to a school in which one child had scarlet fever.
87	„	„	A patient suffering from ozœna and keratitis.
88	„	„	Was sounded for stone, day exposure began.
95	„	—	Attended same school as convalescent children.
117	„	4 days	Mother infected by son with unrecognised scarlet fever.
xxi	3½ days	—	Admitted to fever hospital for supposed typhus fever; attended by a nurse from scarlet fever ward.
8	90 hours	92 hours	Child infected by convalescent sister.
109	102 hours	—	Ward servant in infectious hospital.

TABLE II—(*continued*).

No. of case.	Interval from commencement of exposure to		
	First symptoms.	Rash.	
xxiii	—	4 days	Infected by unrecognised attack in father.
xxiv	—	„	Infected by convalescent patient.
84	—	„	Injury to elbow on day exposure began.
6	96 hours	—	Baby in contact with convalescent children.
19	—	4 days	Child infected by mother.
49	4 days	—	Infected by convalescent patient.
50	„	—	Ditto.
51	„	—	Ditto.
lvi	—	4½ days	In same house with severe scarlet fever.
34	4 days	5 days	Infant returned to infected house.
85	„	6 days	Under treatment for sinus in neck.
lxxiii	—	5 days	In same house with a girl who had visited at an infected house.
64	—	„	Infected by desquamating patient.
12	5 days	„	Infected by sister in early stage.
48	„	—	Infected by convalescent patient.
lxxiv	—	6 days	In same house with a girl who had visited at an infected house.
16	—	„	In same house with sister during her attack.
66	—	„	Returned home to infected house.
81	—	„	Followed operation for cleft palate.
7	5½ days	6½ days	Infected by convalescent patient.
76	5 days	7 days	Patient in infected ward of children's hospital.
77	„	„	Patient in same ward as a case of scarlet fever.
23	6 days	—	Child infected by convalescent patients.
70	„	—	Living in house with patient.
82	„	7 days	In hospital; after operation for lipoma.
17	—	„	In same house with sister during her attack.
65	—	„	Infected by unrecognised case.
71	—	„	Probably infected by fomites.
72	—	„	Ditto.
73	—	„	Ditto.
86	—	„	In hospital; after removal of impacted fæces.
44	7 days	—	Infected by convalescent.
18	—	8 days	Living in house with patient.
96	8 days	„	Attended same school as convalescent.
43	„	—	Infected by convalescent.
46	„	—	Ditto.

Table III.

		117						
	115	108						
	113	107						
	97	106						
	93	105						
	89	104	111					
	63	103	98					
	57	102	85					
	54	101	84					
	42	95	58					
	24	94	51					
	20	92	50					
	11	90	49	112	82			
	xvi	88	34	109	81			
	xv	87	30	64	77	86		
	xiv	32	28	55	76	83		
	xiii	5	25	48	74	73		
	xii	4	19	27	70	72		
	xi	3	8	22	66	71		
91	vii	2	6	12	29	65	96	
31	vi	1	xxiv	10	23	44	75	
26	v	xx	xxiii	lxxiii	16	21	46	
ii	iv	xix	xxii	lvi	7	17	43	
i	iii	xviii	xxi	lv	lxxiv	14	18	
^	^	^	^	^	^	^	^	
Days ... 1	2	3	4	5	6	7	8	

TABLE IV.—*Cases in which exposure ceased at a known date.*

No.	Age.	Interval from cessation of exposure to		Notes.
		First symptom.	Rash.	
xiii (A)	Child	Under 48 hours	—	Left an infected household.
36	Boy	2 days	3 days	Slept in same dormitory at school until appearance of rash.
52	8	—	,,	In same house with sister until her rash appeared.
22	Girl	3 days	—	Exposed to infection by convalescents for two days.
111	Young adult	72 hours	—	Visited an infected house on two occasions.
112	,,	,,	—	Ditto.
53	4	—	4 days	In same house as sister until her rash appeared.
59	2	—	,,	Left an infected household.
61	2	—	,,	Ditto.
lxxv	—	4 days	—	Left an infected school.
38	10	,,	—	Intimately associated at school down to the date when the nature of the illness in the infector was recognised.
39	Boy	,,	—	
40	,,	,,	—	
41	,,	,,	—	
14	1	5 days	—	In same house; intimate association seven days before attack.
56	22	—	5 days	In same house with sister until her rash appeared.
60	22	—	,,	Left an infected household.
67	Child	—	,,	Associated with a boy until his rash appeared.
68	,,	—	,,	
69	,,	—	,,	
80	Adult	—	,,	Nursed a child until case could be diagnosed.
118	Child	—	,,	Left an infected household.
37	Boy	6 days	—	Resided in same house at school.
35	16	,,	8 days	Ditto.
62	12	—	10 days	Left an infected house.

TABLE V.—*Showing probable period of incubation in cases in which infection was derived from milk.*

Case No.	Probable incubation period.	
	To first symptoms.	To rash.
	A. *Cases in which the milk was only taken on a single occasion.*	
129	—	30 hours
132	—	,,
119	24 hours	36 hours
viii	34 to 40 hours	—
ix	,,	—
x	,,	—
131	—	2 days
134	—	4 days
117	2 days	5 days
118	—	,,
133	—	,,
	B. *Cases in which the use of the milk began at a known date.*	
127	—	2 days
113	2 days	3 days
114	—	,,
115	—	,,
116	—	,,
128	—	,,
130	—	,,
120	3 days	4 days
121	,,	—
	C. *Cases in which the use of the milk ceased at a known date.*	
122	36 hours	2 days
123	,,	,,
124	—	,,

TABLE VI.—*Showing cases in which infection was conveyed by patients in an early stage of the disease.*

No.	Circumstances under which infection occurred.	Incubation period to rash.
29	Interview with patient with sore throat; day before rash	6 days
37	In same house at school as a boy who was isolated when he sickened	,,
38		4 days
39		,,
40		,,
41		,,

TABLE VI—*continued.*

No.	Circumstances under which infection occurred.	Incubation period to rash.
xxii	Played with a child who was sickening . . .	4 days
30	Infant nursed by patient with rash, first day . .	5 days
35	In same house at school with boy who was isolated when rash appeared	6 days
36		2 days
52	In same house with sister who was isolated when rash appeared	3 days
53		4 days
56		5 days
74	Children in hospital in intimate relations with a child who was removed when rash appeared	6 days
75		8 days
116	Rash day after sister, who was first case in the house .	2 days

TABLE VII.—*Showing cases in which infection was traceable to persons who had recovered for various periods.*

No.	Condition of infector.	Incubation period not more than
22	Discharged from infectious hospital after 30 days' residence	5 days
23	,, ,, ,, ,, ,, ,, ,,	6 days
1	,, ,, ,, ,, ,, 6 weeks' ,,	52 hours
2	,, ,, ,, ,, ,, ,, ,,	3 days
3	,, ,, ,, ,, ,, ,, ,,	,,
6	,, ,, ,, ,, ,, ,, ,,	4 days
8	,, ,, ,, ,, ,, ,, ,,	4½ days
43	,, ,, ,, ,, ,, 7½ weeks' ,,	8 days
7	After discharge from infectious hospital	5¼ days
32	,, ,, ,, ,, ,, ...	3 days
44	,, ,, ,, ,, ,, ...	7 days
45	,, ,, ,, ,, ,, ...	10 days
46	,, ,, ,, ,, ,, ...	8 days
47	,, ,, ,, ,, ,, ...	9 days
48	,, ,, ,, ,, ,, ...	5 days
49	,, ,, ,, ,, ,, ...	4 days
50	,, ,, ,, ,, ,, ...	,,
51	,, ,, ,, ,, ,, ...	,,
95	Three weeks after onset of slight attack	3 days
96	,, ,, ,, ...	8 days
xxiv	Fortieth day after onset; third desquamation . . .	4 days
27	Convalescent about 6 weeks	5 days
58	Eight weeks after onset; second desquamation . . .	4 days
5	(Scarlet fever in house "lately").	3 days
105	About 3 weeks after being "ill with scarlet fever" . .	,,
113	Sixty-six days after onset of scarlet fever	2 days
xiv	Brother "brought home convalescent from scarlet fever" .	,,

CASES.

Cases 1 *to* 8.

Communicated (from the London Fever Hospital) by Mr. SHIRLEY MURPHY, 1879.

H., patient in the London Fever Hospital for scarlet fever, after six weeks' illness, twelve baths, having finished desquamating and clothes having been disinfected, returned home on a Friday afternoon. He at once came in contact with his sister, J. H. (*Case* 1). J. H. had sore throat on Sunday evening, and rash on Monday morning—less than fifty-two hours from return of H. to J. H.'s sore throat, and about sixty hours to her rash.

L. S., in the London Fever Hospital for scarlet fever, after about six weeks' illness went home into the country on June 20, arriving at 8 P.M., and at once coming in contact with her brother and sister (*Cases* 2 and 3). On June 23, seventy-two hours after return of L. S., her brother and sister began to sicken, and on following morning they had scarlet fever rash. (M. O. H.'s report.)

E. W. (*Case* 4) came from the country, where she had not been exposed to scarlet fever, to nurse her sister, who was suffering from scarlet fever. Sixty-nine hours after her arrival she was attacked with sore throat and nausea, the commencement of an attack of scarlet fever, for which she was admitted into the London Fever Hospital.

H. R., aged 11 (*Case* 5), living at Croydon, where, as far as could be ascertained, she had not been exposed to scarlet fever, arrived, on the afternoon of October 8, at a school in London where there had been scarlet fever lately. On the afternoon of October 11, seventy-two hours after her arrival, she felt faint and ill, and on October 12 was admitted into the London Fever Hospital with scarlet fever.

Three children were admitted into London Fever Hospital on June 15 with scarlet fever. They went from the London Fever Hospital to the sea-side direct, without going home, on July 21. The baby (*Case* 6), who had not been in contact with them since June 15, joined them at the sea-side on July 28; on the evening of August 1 the baby retched, and on August 2 was admitted into the London Fever Hospital with scarlet fever. Interval between arrival at sea-side and retching, about ninety-six hours.

M. S., in the London Fever Hospital with scarlet fever was discharged on June 9, and went into the country until June 15, when she returned home and slept with her sister, L. S. (*Case* 7), on the night of June 16; L. S. awoke with sore throat during the night June 20—21, and on the morning of June 22 had scarlet fever rash on chest. (Five and a half days from return of M. S. to L. S.'s sore throat and about six and a half days to rash.) "All sorts of disinfection done."

F. B., after being in London Fever Hospital for six weeks with scarlet fever returned home on October 23 at 5 P.M., and came in contact with his sister, H. B. On October 27, at 11 A.M, H. B. (*Case* 8) was found to be ill, and at 1 P.M. a scarlet fever rash was found on her chest —not more than ninety hours from exposure to first symptom, and ninety-two to rash.

Case 9.

Communicated by Mr. H. Coupling, Brighton (1879).

A boy, X., at school, found to have scarlet fever; the other boys were sent out, and X. taken on foot to the sanitorium; at door X. was met and embraced by a boy, Y. (*Case* 9), returning for a handkerchief. That day fortnight Mr. Conling was called to Y., and found him suffering from a serious attack of scarlet fever, with which he had sickened the night before. This was the only other case in the school, and Y. was under the same conditions as the other boys with the exception of the handkerchief incident. (No statement as to fomites, or possible recurrence of the source of infection as in X.'s case, which was not ascertained.)

Case 10.

Communicated by Dr. E. T. Wilson.

Dr. Wilson saw an isolated case of scarlet fever for the first time on the afternoon of November 10; during examination of the throat, which was much inflamed, the patient coughed violently. On November 15, in the evening, Dr. W. had a sore throat, and on November 17 the rash of scarlet fever on the elbows. This was his second attack.

Case 11.

Communicated by Dep. Insp. Gen. W. W. Baynes, R.N.

On October 17, the nurse of reporter's daughter went to stay with friends at a town where scarlet fever "was raging in a severe form;" on October 20 she returned, and slept that night in the same room with the child, aged 5. The child was taken ill on the evening of October 22, and on October 23 the rash was observed; forty-eight hours after the nurse's return the child was ill, and sixty hours after her return the rash was seen. No case of scarlet fever existed in the neighbourhood at the time; the nurse said she had had scarlet fever in childhood.

Cases 12 *and* 13.

Communicated by Dr. Spottiswoode Cameron.

C. H., aged 8, who dwelt with her family in one room and an attic, was attacked with scarlet fever on January 28, had sore throat on January 29, and rash on January 31. No other known cases in immediate neighbourhood. On February 2, five days after C. H. began to be ill, her brother, J. H., aged 4 (*Case* 12), who did not go to school, was ill in the morning, could not eat his breakfast, and had rash by dinner-time.

F. C., aged 8, vomited and had rash on December 7. Her brother, A. C. (*Case* 13), had rash on December 17. F. C. had began to run about a few days previous to December 7.

Cases 14 *and* 15.

Communicated by Dr. Ford Anderson.

[These cases were published by Dr. Murchison in an appendix to his paper, *Trans.*, vol. xi, p. 264.]

M. C. H. (*Case* 14), aged 1 year, on March 16 played in the bed of a boy, H. M. A., who on that morning was found to have scarlet fever;

H. M. A. was isolated, but M. C. H. remained in the same house until March 18, when he was removed to lodgings known to be free from infection, and was carefully guarded from every possible source of infection. On March 23, M. C. H. was attacked with scarlet fever, (five days) after he was moved into lodgings, and seven days after H. M. A. was isolated.

C. A. (*Case* 15), reporter's son, was playing with H. M. A. (see *Case* 14) on March 15, *i. e.* the day before H. M. A. was found to have scarlet fever; C. A. was attacked with scarlet fever on March 24—nine days after playing with H. M. A. But Dr. Ford Anderson saw *Case* 14 (M. C. H.) on March 23—thirty-six hours before C. A. was attacked—he touched the child's skin, but quickly withdrew; he returned home in an hour and lunched in the same room with C. A.

Cases 16 *to* 20.

Communicated by Dr. BARNES, of Eye.

A_1, aged 6, on April 29, a few days after visiting a village in which there was scarlet fever, developed rash of scarlet fever. Her three brothers developed rash of scarlet fever—A_3, aged 7 (*Case* 16), on May 5; A_2, aged 8 (*Case* 17), on May 6; and A_4, aged 4, on May 12. The case of A_4 is not tabulated, as the source of infection is doubtful; it may have been A_3 or A_2.

A girl, aged 8, residing in an isolated house, developed the rash of scarlet fever on September 19; source of infection unknown, no cases in neighbourhood. Eight days later, on September 27, a brother aged 6 (*Case* 18), and ten days later, on September 29, another brother, aged 4, developed the rash of scarlet fever.

A woman, aged 36, developed the rash of scarlet fever on September 27, and her child (*Case* 19), aged 3, on October 1, four days after the rash appeared on her mother.

Mrs. S. (*Case* 20), residing in a district where there was no scarlet fever, went to London on a Tuesday, and slept that night in a bed which a child suffering from scarlet fever had occupied the previous night. She returned home on Wednesday, felt unwell on Thursday, and rash developed on Friday morning—the second morning after sleeping in the infected bed.

Case 21.

Communicated by Dr. BRUCE LOW, then (1878) of Helmsley.

On June 1, a man and his wife, who resided at a distance, paid a visit to a butcher and his wife who resided in an isolated country village in a sparsely populated district, in which no case of scarlet fever had occurred for months. The woman visitor took off her bonnet and shawl in the bedroom in which the butcher slept. About two months before this the visitors had lost a child from scarlet fever, and had had a second child very ill at the same time; the crape mourning which the mother wore on June 1 was made up during the convalescence of the second child; these people resided in a small house, and Dr. Low found that "no measures had been taken to prevent the contagion from permeating the whole house." The butcher (*Case* 21) was seized with sickness on the night of June 8—just over seven days after the visit—and when first seen by Dr. Low on June 10 had a "well-developed

scarlatinal rash; " the butcher's wife did not take scarlet fever at this time, but she had had scarlet fever in her youth.

Cases 22 *to* 25.

Communicated by Dr. R. Boxall, London.

A mother, who began with scarlet fever on April 29, and her infant, who had scarlet fever seventeen days later, were discharged from Stockwell Fever Hospital on June 15, and returned home that day. On June 17 one of her two other children (*Case* 22) went to Oxford, where, so far as could be ascertained, there was no scarlet fever at the time, and on June 20 (five days after her mother's return from Stockwell Hospital, and three after she herself left home) she was taken ill with scarlet fever; the other child (*Case* 23) was taken ill with scarlet fever on June 21 (six days after her mother's return). It was "practically certain" that the mother took the infection in the lying-in hospital in which she was confined.

A girl, aged 8 (*Case* 24), played, on Friday afternoon (2—6 P.M.), with the children of the head master of a large school. Three of these children were at the time suffering from mild scarlet fever; they had a rash, but the nature of their illness was at that time unrecognised. On the following Sunday evening (forty-eight hours after playing with the master's children), *Case* 24 began to feel ill, and on the next morning had well-developed scarlet fever. There was subsequently an epidemic in the school.

Reporter (*Case* 25), when Obstetric Assistant at University College Hospital, visited a woman recently confined, who had three children in bed together ill with what ultimately proved to be scarlet fever, on a Monday at 1 P.M. He did not see her again. On Thursday, about 5 P.M. (seventy-six hours after the visit on Monday), he "was taken ill with violent sore throat," and on the "next day there was no doubt as to the nature of the case." There was a good deal of scarlet fever in the neighbourhood at the time, and Dr. B. subsequently ascertained that at another house which he visited a week or ten days before, the door was opened to him by a boy who had the disease.

Case 26.

Communicated by Dr. Ratcliffe-Gaylard.

C. D. visited X., a man suffering from scarlet fever, on the fourth day of the illness, while the rash was profuse, and sat with him for ten minutes. C. D. walked across some fields about a mile, and then called on a friend. One of the friend's boys, A. B., aged 8 or 9, stood close to C. D., within the embrace of his arm and in contact with his coat. A. B. complained of sore throat twenty-four hours after, and within thirty hours had high temperature and rash; the disease subsequently ran the usual course. X. in all probability contracted the disease from his daughter, who was convalescent from scarlet fever when he sickened. X., his child, and A. B. were the only cases of scarlet fever known in the neighbourhood. A. B. did not attend the same school as the other child, and had never come in contact with X. or his daughter. A. B. a few weeks previously had had measles, and the reporter suggests that "this may account for his extreme susceptibility." C. D. was an adult who had had scarlet fever several years before; the time between his

leaving X. and coming into actual contact with A. B. was about forty or sixty minutes.

Case 27.

Communicated by Dr. J. H. SPENCER, Holbeach.

A young lady who had been from home for two months, and had neither heard of nor seen any cases of scarlet fever, on her return home called at a house where the children had had scarlet fever, but had been convalescent and about for six weeks. She was attacked by scarlet fever five days later, and died in a week.

Case 28.

Communicated by Dr. T. F. PEARSE.

M. D. saw a case of scarlet fever on Monday afternoon. He had no other cases of scarlet fever in his practice, and did not see this case again. On Friday (about ninety-six hours after seeing the case) he felt ill, and on Saturday afternoon he showed the rash of scarlet fever.

Cases 29 *and* 30.

Communicated by Dr. F. W. JOLLYE.

A medical student returned home with a sore throat on Friday, and on Saturday had rash of scarlet fever. On Friday afternoon a young lady (*Case* 29) called at the house, and remained talking in the same room with the medical student. On the following Thursday evening the young lady complained of sore throat, and subsequently had a rather severe attack of scarlet fever six days from exposure to sore throat.

A servant girl was sent home by her employers as soon as she was found to have the rash of scarlet fever. Arrived at her home, an isolated house on the Wiltshire Downs, she nursed the youngest child, aged 5 (*Case* 30). After being at home one and a half to two hours, she was removed to a fever hospital. Case 30, aged 5, had malaise four days afterwards, and the rash of scarlet fever on the next following day.

Cases 31 *to* 33.

Communicated by Dr. A. HILL, Medical Officer of Health, Birmingham.

L. H. aged 9 (*Case* 31) visited a cousin who had scarlet fever on July 31; on August 1 she was taken ill with sore throat, sickness, and purging, and the eruption appeared the same evening. She was admitted to hospital on August 2. From exposure to first symptoms, one day.

Two sisters were discharged from the Birmingham City Infectious Hospital on the evening of August 3. A third sister, E. J. (*Case* 32), aged 5, sickened on August 6; eruption appeared on August 9. From return of convalescent sisters to first symptoms not more than three days.

E. W. (*Case* 33), aged 7, was admitted to above hospital on November 5, certified as having had scarlet fever, which, however, she had

not had. On November 17, twelve days after admission, she was taken ill with scarlet fever.

Case 34.

Communicated by Dr. F. R. Humphrey, Haverstock Hill.

B., aged 17 months, who, in consequence of cases of scarlet fever being in her mother's house, had been at her grandmother's house in the neighbourhood, was taken home on December 19. On December 22 she had "a cold in her eyes," on December 23 both tonsils were swollen, and on December 24 she had the rash of scarlet fever. Three days to sore eyes, four days to tonsillitis, five days to rash.

Cases 35 *to* 41.

Communicated by Dr. Clement Dukes, Medical Officer to Rugby School.

M., aged 15, in Mr. Wh.'s house, Rugby School, had sore throat on November 7, rash on November 8, and was removed to hospital on the last named date. W., aged 16 (*Case* 35), in the same house, had sore throat on November 14, and rash on November 16. W.'s sore throat seven days after M.'s, and six days after M.'s isolation.

J., in Mr. M.'s house, had sore throat on January 31, rash on February 1, and was removed to hospital on last named date. N. (*Case* 36), who slept next him in dormitory, had sore throat on February 3 and rash on February 4; N.'s sore throat three days after J.'s, and two days after J. was isolated. J., when convalescent on February 13, was placed in a room with a third boy who was in the early stage of a severe attack of scarlet fever. J. had tonsillitis on February 26, and had an eruption of scarlet fever again on March 1.

P., in Mr. Wn.'s house, sickened with scarlet fever on March 21, and was sent to sanatorium. Cn. (*Case* 37), in same house, sickened on March 27, six days after P. was isolated.

T., aged 12, sickened and was isolated on May 7. C. (*Case* 38), aged 10, in the same house, sickened on May 11, four days after T. was isolated.

W., aged 17, sickened on February 21, and was isolated on that day. C. (*Case* 39), in the same house, who was working with W. the night before he was isolated, sickened on February 25, four days. B. J. (*Case* 48), in the same house as W., sickened on February 25, four days. H. (*Case* 41), who was visited by W. in his study on February 21, and lived in the same house as W., also sickened on February 25.

Cases 42 *to* 51.

Communicated by Dr. Mark Fenton, Medical Officer of Health, Coventry.

A. G. (*Case* 43), who had never had scarlet fever, entered the scarlet fever ward of the City Fever Hospital on December 27, in the evening. On December 29, forty-eight hours after exposure, the first symptom appeared. A. G. had arrived at the hospital from the country on December 27.

L. S., attacked with scarlet fever August 8, was discharged from the Fever Hospital on September 28, returned home, and immediately resumed association with sisters, one of whom, J. S. (*Case* 43), was attacked on October 6, eight days after return home of L. S.

L. was discharged from the Fever Hospital on December 15, and re-

turned home. Another child (*Case* 44) in the same family was attacked on December 22, seven days after return home of L.

Sh. was discharged from the Fever Hospital on December 22. A second case (*Case* 45) appeared in the same family on January 1, ten days after return home of Sh.

Si. was discharged from the Fever Hospital October 14. A second case (*Case* 46) occurred in this family on October 22, and a third case on October 23, eight and nine days respectively after return of Si.

W. was discharged from the Fever Hospital on September 27. A second case (*Case* 48) occurred in the same family on October 2, five days after the return of W.

T. was discharged from the Fever Hospital on December 27. A second case (*Case* 49) in this family appeared on December 31, four days after return of T.

H. was discharged from the Fever Hospital on November 10. A second and a third case (*Cases* 50, 51) appeared in the family on November 14, in both cases four days after H.'s return.

Cases 52 *to* 66.

Communicated by Dr. ARTHUR WHITELEGGE, Medical Officer of Health to the West Riding County Council.

Two boys, aged 4 and 8, were in the same house with a sister, who was taken ill one day and had rash next day. Upon the appearance of the rash the boys were rigidly isolated in another house. The elder had a scarlet fever rash three days after isolation, the younger four days after isolation. The intervals here were three days (about) and four days (about) respectively from rash to rash.

A girl, aged 3 (*Case* 54), played with a child suffering from scarlet fever one day, and had scarlet fever rash two days later.

A boy, aged 2 (*Case* 55), was in close contact with an infected child for a short time only, and had scarlet fever rash five days later.

A young man aged 22 (*Case* 56) was in the same house with his sister, who was taken ill one day, and had the rash the next day. Upon the appearance of the rash the young man immediately left home, but had scarlet fever rash five days later.

A servant girl aged 20 (*Case* 57) visited her home, where her brother was recovering from scarlet fever, on Sunday evening, between 6 and 9 P.M. She afterwards returned to the house in which she was in service, and did not go out again. On Tuesday morning she had scarlet fever rash, about thirty-six hours after visiting the infected home.

B., a girl aged 19 (*Case* 58), slept one night with a cousin who was undergoing a second desquamation on the feet, eight weeks after the original attack. B. had scarlet fever rash four days subsequently.

A boy aged 2 (*Case* 59) came to Nottingham from an infected household in the country, and had a scarlet-fever rash four days later.

A woman aged 22 (*Case* 60) left an infected house in Ireland, and had a scarlet-fever rash in Nottingham five days later.

A girl aged 2 (*Case* 61) was sent away from an infected house, and had scarlet fever rash four days later.

A girl aged 12 (*Case* 62) left an infected house and had a scarlet fever rash ten days later.

A girl aged 12 (*Case* 63) was admitted to a scarlet fever ward upon

a mistaken diagnosis one day at noon. Two days later she had high temperature and vomiting, and in the evening a scarlet fever rash appeared—about fifty-four hours after admission to hospital.

A girl (*Case* 64), desquamating after scarlet fever, went to live in a household, and a boy aged 5 years had scarlet fever rash five days later.

A girl, X., coming from a house in which scarlet fever was prevalent, and herself suffering from a sore throat, the specific nature of which was not recognised, went to reside in another house. Seven days after X.'s arrival, a girl, aged 2 (*Case* 65), in the house had scarlet-fever rash. A succession of cases followed in this household, the last being that of a girl aged 3 (*Case* 66) who returned to the house after seven weeks' absence, and had scarlet-fever rash six days later.

Cases 67 *to* 69.

Communicated by Dr. HUGH W. STATHAM, Medical Officer to the Foundling Hospital.

A boy in the infants' school of the Foundling Hospital had scarlet fever rash on August 3. On August 8 three other infant school boys were admitted to infirmary for scarlet fever rash.

Case 70.

Communicated by Sir GEORGE BUCHANAN, M.D., F.R.S.

"First two cases in the town of Dartmouth in 1870. Case A was ailing on February 7, rash observed February 9; means of infection doubtful. Case B., brother of A., living in the same house, sickened on February 15" (*Case* 70) six days from A.'s rash.

Cases 71 *to* 73.

Communicated by Dr. C. HAIG-BROWN, Medical Officer to the Charterhouse School, Godalming.

At the end of 1887 an outbreak of scarlet fever occurred at Charterhouse, Godalming. The school reopened on September 19. At this time scarlet fever of a mild type was prevalent in the East of London, and on September 24 one of the boys, L., received a parcel of new clothes which had been put out for sewing in the East End. L. opened the parcel in his cubicle at 9 P.M. on September 24. L. had scarlet fever on October 1; two other boys—O. and B.—intimate friends of L.'s, and sleeping near him, also had scarlet fever on the same day—October 1, seven days after the parcel was opened. An epidemic ensued, all the cases being of a mild type.

Cases 74 *to* 93.

Communicated by Mr. J. SCOTT BATTAMS.

A. B., a child with a burn of the arm, was admitted to the East London Hospital for Children, Shadwell, on the morning of November 24, and in the evening of the same day she came out with scarlet fever rash, and was sent to the Fever Hospital that night. During the afternoon of November 24, C. D. (*Case* 74) was nursed with A. B. on the same nurse's lap. C. D. left the hospital on November 25, but was brought back with difficulty of swallowing and a scarlet-fever rash on the morning of November 30, six days after admission of A. B.

E. F. (*Case* 75), who had been admitted for ulceration of the vulva,

slept in the next cot to that in which A. B. was placed on November 24. On December 2, E. F. complained of sore throat and vomited, eight days after admission of A. B., and on December 3 scarlet-fever rash appeared. (The above cases were published in the *British Medical Journal*, vol. ii, 1882, p. 1248.)

The following cases communicated to the Committee in 1889 were observed at the East London Hospital for Children, Shadwell, and were selected by Mr. Battams as having all been infected after admission, cases in which there was a probability of infection before admission being excluded. All the cases were known to have been exposed to infection after admission.

Case 76.—James M., admitted September 28 for anæmia. Temperature normal till October 3; rash October 5, seven days after commencement of exposure.

Case 77.—Arthur H. was admitted for genu valgum on November 16 into a ward in which there had been a case of scarlet fever on November 13; another child in this ward (*Case* 81) came out with rash of scarlet fever on November 21. Arthur H.'s temperature remained normal until November 21; rash on November 23, seven days after admission and two after commencement of the last case in that ward.

Case 78.—Nurse B., in good health, and not previously exposed to infection, came up from the country and began duty as a probationer on January 24. She was exposed to the infection of scarlet fever, and on February 1 (eight days after entering the hospital) she vomited, and had sore throat "very like scarlet fever;" no rash was noticed, but temperature was high, urine contained a trace of albumen, and desquamation was noticed on February 8. (On February 24 she developed diphtheria, and died February 27.)

Case 79.—Nurse M., in good health, and not previously exposed to infection, came to hospital and commenced duty in above ward on February 5; she nursed, among others, a boy (admitted January 24) who was removed with scarlet fever on February 10. Nurse M. developed scarlet fever on February 15 (five days after the boy was removed).

Cases of Injury or in which an Operation had been performed.

a. Cutting Operations.

Case 80.—Lydia M., was admitted on September 10, and a lipoma removed from the arm that day. The temperature was normal till September 16; rash September 17, seven days after operation.

Case 81.—Edward G., admitted November 15. Operation for cleft palate November 18; rash on November 21, six days after admission, three days after operation; last case of scarlet fever in this ward, September 13.

Case 82.—Arnold W., admitted August 24. Tonsils removed August 30. He remained quite well with normal temperature up to September 21, when operation for cleft palate was performed. Rash September 24. "Infection in hospital certain."

Case 83.—Robert B., aged 8, was brought to the hospital in a private conveyance on February 28, was circumcised, and returned home without seeing any other patient. At home he was kept in bed in a

room by himself, and was attended only by his mother. He was brought to the hospital again on March 3, and sat for some time on a form in close contact with a child who attended to have a scald dressed and was found to be "full out in scarlet fever rash." Robert B. was taken home as before, entirely isolated and attended only by his mother. His mother stated that he vomited on March 10, was feverish, complained of sore throat, and the skin was red (seven days after exposure). On March 11 he was brought to the hospital, and found to be "full out in scarlet fever rash." There were no other children in the house, and there had been no scarlet fever.

β. Other Operations and Injuries (except Burns and Scalds).

Case 84.—Mabel G., admitted with injury to elbow on October 27. The temperature remained normal until October 29. Rash on October 31, four days.

Case 85.—George C., admitted on November 19 with a sinus in the neck. He vomited on November 23 (four days), and had rash on November 25 (five days).

Case 86.—Mary S., aged 10 months, was admitted on November 22 for stricture of anus; fæces were scooped out. The temperature was normal till November 29. Rash same day (seven days after operation).

Case 87.—Ethel C., admitted May 9 with ozœna and keratitis. Temperature normal till May 12 (three days). Rash May 13.

Case 88.—Edward O. was admitted on February 28, and sounded for stone. He remained quite well until March 3, when the temperature was 103° F. (three days). Rash March 4.

γ. Scalds and Burns.

Case 89.—Joseph L., admitted November 25 with scald of chest. Rash November 27 (two days).

Case 90.—Ellen M., admitted January 8 with burn of face. Rash January 11 (three days). There had been no case of scarlet fever in the ward for three weeks, and the admission of cases to that ward had been stopped for that period.

Case 91.—Harry K. was admitted on February 12 with scald of back. Rash February 13 (one day). The ward had been cleaned and fumigated with sulphur since last case.

Case 92.—Edward C., admitted on March 4. Rash March 7 (three days). There had been no case in the ward since February 16.

Case 93.—Clement D., admitted January 23 for scalds. Rash January 25 (two days). Two children in adjoining beds removed with scarlet fever on January 22 and 24.

The following table summarises the facts in the foregoing notes:

No. of case.	Nature of operation.	Scarlatina appeared.			
		First symptoms.		Rash.	
		After admission.	After operation.	After admission.	After operation.
	Cutting Operations.				
81	Cleft palate . . .	—	—	6	3
82	,, . . .	—	—	31	3
80	Excision of lipoma . .	6	6	7	7
	Scalds and Burns.				
91	Scald	—	—	1	—
89	,, ...	—	—	2	—
93	,, ...	—	—	2	—
90	Burn	—	—	3	—
92		—	—	3	—
	Other Operations and Injuries.				
84	Injury to elbow . .	2	—	4	—
87	Ozæna and keratitis .	3	—	4	—
88	Sounded for stone . .	3	3	4	4
85	Sinus in neck . . .	4	—	6	—
86	Anal stricture; fæces scooped out . . .	7	—	7	—

Communicated by Sir GEORGE BUCHANAN, late Medical Officer to the Local Government Board.

Case 94.

Dr. H. F. PARSONS' Report to the L. G. B. on the Prevalence of Scarlet and Enteric Fever in the Castleford Reg. S. D., &c. (May 24, 1880).

In January, 1879, there was a large family gathering at a funeral in Methley. It was attended by persons from Castleford, who brought a child with them; these persons had scarlet fever in their house at the time. A child living at Methley, who was at the funeral, was taken ill with scarlet fever three days afterwards, and died after two days' illness. This was the first case in Methley.

Cases 95, 96.

Dr. PARSONS' Report to the L. G. B. on the Prevalence of Scarlet Fever at Potton, &c. (December 28, 1882).

Two children who contracted scarlet fever at home sickened about August 27. They passed through slight attacks, and went back to school about September 17. On September 20 and 25 two children of different households attending this school were taken ill.

Cases 97, 98.

Dr. PAGE'S Report to the L. G. B. on the Continued Prevalence of Scarlatina in the Wisbech R. S. D. (April 3, 1883).

On January 15 a mother and child residing in a farmhouse in Wisbech Fen went to a shop in a neighbouring village, and there came in contact with some members of the shopkeepers' family who were, or had very recently been, suffering from scarlet fever. The child (*Case* 97) sickened on January 17, the mother (*Case* 98) on January 19.

At Upwell scarlet fever began earlier in the year, and gradually increased. The main outbreak was in July, and Dr. Page notes that the following entry appears on the school log-book: "July 13.—Flower show. July 17.—The schools were ordered to be closed owing to the sudden outbreak of scarlet fever. There are nearly twenty cases between the schools and Church Bridge."

Cases 99, 100.

Dr. PAGE'S Report to the L. G. B. on Recent Prevalence of Scarlet Fever at Donington and Moulton, &c. (April 9, 1883).

Infection carried by an individual with ulcerated sore throat.—The epidemic in Moulton originated thus:—H., a young man, came from a village at a distance, suffering from ulcerated sore throat, for which he sought medical treatment. When recovering from his throat illness he "habitually visited" the house of a relative who had four children. One of these four had mild scarlatina, which began about November 18. The other three children continued to attend school, and on November 25 a boy, aged 7, attending the school began with scarlatina, and thereafter other cases occurred.

Infection carried by a healthy person.—The school was closed on December 15, and on that day the assistant mistress, who had not had any even slight attack, went to stay at her brother's house, an isolated farmhouse, the inmates of which had not been exposed to any other risk of infection. Within the same week of her arrival two of her brother's children, aged 2 and 4, were laid up with scarlet fever.

Dr. PARSONS' Supplemental Report to the L. G. B. on the Continued Prevalence of Diphtheria and Scarlet Fever in the Sutton-in-Ashfield U. S. D., May 8, 1883.

Infection transmitted by mild unrecognised cases.—Dr. Parsons, in remarking on the difficulty of diagnosing between diphtheria (q. v.) and scarlet fever, especially in slight and transient cases, says that he was informed that during this epidemic there were "many mild cases of sore throat" which were not seen by any medical man, and that "in some such cases the subsequent occurrence of dropsy has indicated their scarlatinal nature."

Dr. BLAXALL'S Report to the L. G. B. on a Widespread Epidemic of Scarlatina in . . . . . Lower Brixham (March 8, 1889).

Within three days of the reopening of the schools on September 3, three children returned home from school ill with scarlatina. It follows that they had attended there when incubating the disease, and they were in all probability the means of introducing the disease into the schools.

Instances were met with repeatedly of attacks following a few days after a visit to see the body of a child dead of the disease, or attendance at the funeral. The following example is given :—"A child was taken to see the dead body of its little friend, and three or four days afterwards was attacked with scarlatina, and died within the fortnight; subsequently the three remaining children suffered from scarlatina, and the mother from sore throat, while the father suffered from erysipelas."

Many persons stated that the first time their children went out after the fever was to witness the ceremony of laying a memorial stone on the spot where the Prince of Orange landed. Others stated that their children were well when they went to see the stone laid, but four or five days afterwards they were "down with the fever."

Cases 101 *to* 112.

Communicated by Dr. W. Tonge-Smith in a Letter to Dr. Buchanan, and Paper in *Brit. Med. Journ.*, 1883, vol. i, p. 150.

Case 101.—"S. B., certified as scarlatina, was brought to hospital in a scarlet fever ambulance on the evening of May 30, 1879. He was found to have morbilli, and was isolated. May 31: The rash of morbilli had almost disappeared. June 1: Temperature 99°; he felt quite well. June 2: 8 a.m., temperature 103·2°; headache and sore throat. 11 a.m., scarlet rash, &c. Incubation, about sixty hours."

Case 102.—"J. R., certified as having scarlet fever, had an hour's drive in a scarlet fever ambulance between 5 and 6 p.m. on December 27, 1879. On arriving at the London Fever Hospital he was found to have scarlatina, and was isolated. At 7 p.m. on December 30 the temperature was 99·8°, followed by sore throat, vomiting, scarlet rash, &c. Incubation, about seventy-two hours."

Case 103.—"E. R., certified as having scarlet fever, was brought in a scarlet fever ambulance on April 8, 1880, at 3 p.m. He was found to have rubeola, and was isolated. On April 10, towards night, he had slight sore throat; temperature normal. On the 11th, in the morning, his condition was the same. Towards evening his temperature was 99°; throat much worse, followed by sickness, rash, &c. Incubation, about seventy-two hours."

Case 104.—"S. G., certified as having scarlet fever, was brought in the scarlet fever ambulance on March 29, 1881, at 3 p.m., and was found to have rubeola, and was isolated. No symptoms of scarlatina appeared till April 1, at 7 a.m., when the patient had headache, sore throat, fever, and then rash, &c. Incubation, sixty-four hours."

Case 105.—"H. H., on the morning of October 30, 1879, met friends at Regent Circus, and rode with them in an omnibus to the Marble Arch. There he left them, and had no further communication with them. He had not had anything to do with them for some weeks previously, as some members of the family were ill with scarlatina. Two of those whom he met had themselves been taken ill with scarlatina about three weeks before. The boy continued well till November 2, 1879, when, in the morning, he had sore throat, followed by rash, &c. Incubation, about seventy-two hours."

Case 106.—"J. O'B., certified as having scarlatina, was brought from an important hospital and medical school, and was said to have been isolated some days. He reached the London Fever Hospital at 11 a.m.

on November 4, 1879. There was no sign of scarlatina or other acute specific disease. On faith in the authority (I very soon got over faith in the authority) I myself put the patient in the scarlet fever ward. No symptom of anything wrong appeared until November 7, when, at 9 A.M., he had sore throat, and his temperature was rising. At 1 P.M. he had scarlatinal rash, &c. On the 10th desquamation was beginning. Incubation, seventy hours, not more."

Case 107.—"A. R., certified as having scarlet fever, was placed in the scarlet fever ward on the afternoon of December 24, 1879. On December 26 he was feverish at night; temperature normal. On December 27, during morning, the temperature was 101°; in the afternoon he had sore throat, rash, &c. Incubation, about sixty-four hours, not more."

Case 108.—"M. P., nurse at the London Fever Hospital, arrived on April 1, 1880, at night. On April 2, at 7 A.M., she for the first time entered the scarlet fever wards, and remained on duty in these wards until April 5, when, shortly after 7 A.M., she suddenly had sore throat, &c., followed by rash. Temperature 103°. Incubation, about seventy-two hours, not more."

Case 109.—"M. F. C., ward-servant, began work on entering hospital at 9 A.M., March 28, 1881, and remained well till 3 P.M. on April 1, when she had sudden sore throat; temperature 103·6°, followed by rash, &c. Incubation, one hundred and two hours, not more."

Case 110.—"G. H. was sent in with *Case* 106, at the same time, from the same place, under the same conditions, and by the same authority. There was no sign of illness. In a credulous mood I myself put the patient in the scarlet fever ward. There was no sign of scarlatina whatever till November 17, 1879, in the afternoon, when he had sudden vomiting, sore throat, &c., followed by scarlet rash, temperature 103·4°. He desquamated subsequently. Incubation, thirteen or fourteen days (?), not more, certainly. These were the only two cases sent in; both recovered perfectly."

This case, Dr. Tonge-Smith remarks, "shows nothing more than that it is possible to live in the midst of the infection of scarlatina for a fortnight without showing signs of the disease. Amongst nurses and servants I have known of several such cases, which have little practical importance. In this connection I may remark that I have known some cases lie in bed in a well-ventilated scarlatina ward for two or three weeks and not develop the disease, but to do so towards the end of the third day after getting up and coming to closer quarters with the other patients."

Case 111.—"A young lady visited a dressmaker on February 11, 1880. She saw there a sick child (the mother said it had sore throat). She went again on February 12 to have her clothes fitted, and again saw the child. On February 15 she was attacked with scarlatina. Incubation, about seventy-two to ninety-six hours."

Case 112.—"A sister of *Case* 111 left home before her sister was attacked, and in consequence stayed with a friend. She visited the same dressmaker on March 10, 1880, at 5 P.M. On March 12 she went again to be fitted. On the 15th she had sore throat, &c., followed by scarlatinal rash. Incubation, about seventy-two to one hundred and twenty hours."

Dr. Tonge-Smith adds, "Since getting the above facts of these two cases I have been told that possibly there may have been another source of infection common to both sisters, that of a young lady who

had an illness which her friends thought might have been scarlatina, but which the medical attendant said positively was not."

If the disease in *Cases* 111 and 112, he adds, "were contracted from the child, though they differ in their maximum limit, they strangely agree in their minimum—seventy-two hours; and this, moreover, dates in each case from the most important point in the history—that is, the trying on of the clothes, which had lain for twenty-four to forty hours in the supposed infected house."

Cases 113 *to* 118.

Communicated by Dr. W. Squire.

These cases were published by him in his *Essays in Preventive Medicine*, 1887, p. 87.

A boy (*Case* 113) went to meet his sister, who had commenced with scarlet fever sixty-six days before, at the station, and sat opposite to her in a closed carriage. She had been in quarantine for a month, and her return took place on March 20. On March 22 the boy was ill, vomited, and was restless at night; on March 23 he had sore throat and rash—less than two days from return of sister to initial symptoms in boy.

A girl (*Case* 114), aged 10, came from school with scarlet fever on July 4. On August 14, six weeks after commencement of her illness, she joined her two younger brothers at the sea-side. The youngest, aged 5, had sore throat on August 16, and the full rash of scarlet fever on August 20—two days from return of sister to sore throat.

Two children, A. and B., lived in an isolated house. On February 17, A. (*Case* 115), aged 4, was taken to a London hospital; infection was attributed to a child met on this occasion, the only one on which any communication with others could be traced. On February 19 A. vomited; on February 20 she had sore throat, and the rash appeared on February 21. B., aged 2 (*Case* 116), had some difficulty in swallowing on the evening of February 20 (before the rash had appeared on A.), was ailing on February 21, and had rash on February 22.

A boy who had been at a school broken up on account of an epidemic of scarlet fever, and who had himself had a sore throat, returned home on December 3, 1861. On December 6 the mother (*Case* 117) became ill (three days after boy's return) and on December 7 she had rash of scarlet fever. One of the boy's sisters, aged 11 (*Case* 118), who was sent away from home on December 7, had scarlet fever on December 12, five days after leaving home. Two other sisters, aged 12 and 10 respectively, who went away with the girl aged 11, escaped altogether.

Cases i *to* lxxv.

Cases communicated to the Society in 1878 by the late Dr. Murchison (*Transactions*, vol. xi, p. 250).

Case i.—A female, aged 22, was admitted into the London Fever Hospital on April 22, 1858, on the third day of an attack of scarlet fever, which proved fatal on the eighth day. On April 19 she had come from a part of Oxfordshire where scarlet fever did not exist, to see her sister, who was lying dangerously ill with it in London. She arrived in the afternoon, and on the following morning she was seized

with rigors, headache, and sore throat, and on the 21st a scarlet rash was observed on the skin. Here the period of incubation did not exceed eighteen hours.

Case ii.—Ann W., aged 18, a servant, was admitted into the London Fever Hospital, suffering from scarlet fever, on October 5, 1863. On September 28 a young lady had come from school to the house where Ann W. was in service, ill with scarlet fever, and was waited on by her on the same day. The next day Ann W. was seized with sore throat, followed by the usual symptoms of scarlet fever. In this case the period of incubation did not exceed twenty-four hours.

Case iii.—For the details of this case I am indebted to the late Mr. Marson, of the Small Pox Hospital. About twenty years ago, a family residing in Gray's Inn Lane gave a children's party. Before the day one of their own children fell ill with scarlet fever. Not wishing to put off the party, the child was removed to a garret. The party took place on a Monday, the children being at the house from about 4 to 9 P.M. On the Tuesday, between 11 and 12 P.M., a child, residing in a distant part of London, who had attended the party, but was not known to have been otherwise exposed to scarlet fever, was seized with the usual symptoms of scarlet fever, of which she died on the Friday morning. In this case the period of incubation was somewhere between twenty-six and thirty hours.

Case iv.—On March 19, 1869, about 3 P.M., Mrs. T., aged 40, had a small tumour removed from behind her left ear, by the late Sir William Fergusson. On the evening of the 20th she was taken very ill with fever and vomiting. On the 21st her face and chest were covered with a punctated scarlet rash, which, on the 22nd, when I saw her, had extended to the legs, and had all the characters of scarlatinal rash. The other symptoms of scarlatina were also present. On inquiry it was ascertained that the nurse who had come to attend on Mrs. T., shortly before the operation on the 19th, had just left off nursing a child ill with scarlet fever. Here the period of incubation was less than thirty hours.

Case v.—Mary B., aged 21, was admitted into the London Fever Hospital on September 14, 1863, on the fourth day of an attack of scarlet fever. She had been in service, and on the evening of September 9 she had gone to a "new place," at a house at which some of the inmates were suffering from scarlet fever. On the morning of the 11th she had been seized with vomiting and sore throat, followed by all the ordinary symptoms of scarlet fever. In this case the period of incubation was less than thirty-six hours.

Case vi.—On March 4, 1863, about 4 P.M., W. F., aged 11, a schoolboy, went with some of his schoolfellows to a house in which there were cases of scarlet fever, and remained there about two hours. Early in the morning of March 6 he was seized with scarlet fever, which was followed by gastro-enteritis, terminating fatally on March 23. Here also the period of incubation did not exceed thirty-six hours; but it could not have been much shorter.

Case vii.—On the evening of February 23, 1878, Mrs. M. went from Hampstead to a school at Wimbledon, to nurse her son who was ill with malignant scarlet fever, and on the morning of February 25 she awoke with sore throat and other symptoms of scarlet fever, which ran a mild course. Here also the period of incubation did not exceed thirty-six hours.

Cases viii *to* x. (See below, "Milk Cases," page 171.)

Case xi.—The following case was communicated to me by Dr. Alfred Wiltshire, after reading my paper in the *Lancet* of August 13, 1864, on the latent period of scarlatina:

On March 1, 1864, Mrs. M. took her two children, Robert, aged four and a half, and his brother, aged two and a half, to University College Hospital, the latter having rickety deformity of the legs. They were in the out-patient room from 2 to 4 P.M. While there Mrs. M. sat next to a woman nursing a child who was very ill and had its throat wrapped up, and the woman told Mrs. M. that she had four other children at home ill with "scarlatina and diphtheria." Mrs. M. kept her younger child in her arms, but Robert stood at her side next to the woman with the sick child. Early in the morning of March 3 Robert was taken ill with shivering, sickness, and drowsiness; in the evening of the same day a scarlet eruption began to appear on the skin, which next morning was very copious and bright all over the body; and on March 8 the boy died. The younger child sickened with scarlatina on March 10, and died with pyæmic abscesses on April 7. In Robert's case the period of incubation was not longer than forty hours, and not shorter than thirty-six hours.

Case xii.—Mrs. H., about 30 years of age, student of medicine, carefully examined the rash of a child suffering from scarlet fever at 2 P.M. on March 8, 1878. The examination did not last longer than ten minutes, and she only saw the child on that one occasion. On the morning of March 10 she awoke with sore throat and fever, and next morning she had a copious and typical scarlatina rash. Here the period of incubation did not exceed forty-one hours, and was probably not shorter than thirty-six hours.

Case xiii.—On June 10, 1876, a child, A., left Lincolnshire, and arrived in the evening on a visit to a family residing at Shooter's Hill, near Greenwich. She was then apparently in good health, and there was no illness in the house in Lincolnshire from which she came. But in the night of June 11–12, two children, B. and C., sickened with scarlatina in this house in Lincolnshire; and in the same night A., and D., aged 6, who occupied the same room as A., and had not been away from Shooter's Hill, nor otherwise exposed to scarlatina, fell ill with this disease.

If A. fell ill first, and D. contracted the disease from her, there could have been scarcely any period of incubation; but if, as seemed more probable, the poison was in the clothes of A., or A. gave off the poison during the incubating stage, the period of incubation in D. may have been forty-eight hours, but not longer.

Case xiv.—Mary Jane G., aged 5, was admitted with scarlet fever into the London Fever Hospital in the afternoon of June 20, 1865. Her brother had been brought home convalescent from scarlet fever on the 18th, and in less than forty-eight hours afterwards Mary Jane was taken ill, and brought at once to the hospital. The period of incubation was less than forty-eight hours.

Case xv.—On April 12, 1868, Caroline A., aged 21, was engaged as a nurse in the London Fever Hospital, and on the same day she began duty in one of the scarlet fever wards. On April 14 she was taken ill with what turned out to be a severe attack of scarlet fever. The period of incubation did not exceed forty-eight hours.

Case xvi.—Alexander D., aged 6, arrived from a locality in Scotland

where scarlet fever was then unknown, at an hotel near Piccadilly, late in the evening of March 22, 1873. There had been cases of scarlatina shortly before in this hotel. The exact particulars were kept back; but it was ascertained that a servant, ill with scarlet fever, had been removed from the hotel to a fever hospital a fortnight before, and that some other of the inmates had had sore throat. On the evening of March 24, A. D. was taken ill with sore throat, and next morning, when I saw him, he had a scarlatina rash. In this case the period of incubation did not exceed forty-eight hours.

Case xvii.—Charles D., aged 4, came with his brother, A. D., from Scotland to Piccadilly on March 22, 1873. (*See last Case.*) C. D. awoke at 3 A.M. on March 27 with vomiting and pyrexia, which were the first symptoms of a typical attack of scarlatina. Here the period of incubation could not in any case have exceeded four days and six hours; but, on the supposition that C. D. caught the disease from his brother, which was probable, as they occupied the same room, it did not exceed fifty-four hours.

Case xviii.—Mary H., aged 24, a nurse at the Henrietta Street Nursing Institution, went to nurse a child badly ill with scarlet fever on the evening of March 12, 1865. During the 13th and 14th she did not feel very well. On the morning of the 15th she had sore throat and vomited, and in the afternoon the rash of scarlatina appeared. On March 16 she was admitted into the London Fever Hospital, suffering from scarlatina. The period of incubation in this case could not have exceeded two and a half days.

Case xix.—Miss B., aged 12, returned to school at Kensington on October 5, 1858. A girl at the school was ill at the time with scarlet fever. On October 8 Miss B. felt feverish and had a sore throat, and on October 9 the rash of scarlet fever made its appearance. The disease ran its usual course and terminated favourably. The period of incubation in this case could not have exceeded three days.

Case xx.—T. M., an officer in the Limerick Artillery, aged 22, arrived in London on September 2, 1858. On September 5, in the afternoon, he visited a friend, whose little girl had scarlet fever, but so slightly that she was not confined to bed. He took the girl on his knee and kissed her. On the morning of September 8 he was quite well, but towards evening he was attacked with headache, heaviness, and sore throat, followed by a dusky scarlet rash, ulcers on the tonsils, constant delirium, sleeplessness, and great prostration. He died on September 14 at 11 A.M. In this case the period of incubation was not longer than three days, but neither was it shorter.

Case xxi.—Susan W., aged 16, was admitted into the London Fever Hospital on January 13, 1863, along with her sister, who was ill with typhus. Susan's febrile attack terminated on the seventh day (January 15) with an eruption of herpes on the lips. She never had any typhus eruption, and on January 16 her pulse was 60 and her appetite good. In the night of January 16 she began to complain of pains in the limbs and sore throat, and next day the rash of scarlet fever appeared, and the pulse was 108°. Although this patient was admitted with her sister into a typhus ward, she was attended by a nurse from a ward devoted to scarlet fever. The period of incubation in this case could not have exceeded three and a half days.

Case xxii.—Ellen N., aged 4, was admitted into the London Fever Hospital on May 2, 1863, on the fourth day of an attack of scarlet

fever, which proved fatal from pneumonia on the eleventh day. This child had been living in a locality where scarlet fever was not known to exist, but on April 25 she had been taken to the workhouse of St. George's-in-the-East, and on the same day she had played there with a child who was then sickening with scarlet fever, and who was admitted into the London Fever Hospital with this disease in a malignant form on April 27. Ellen N. was taken ill with headache and sore throat on April 29, and the scarlet rash appeared on April 30. Here the period of incubation could not have exceeded four days.

Case xxiii.—In the afternoon of May 14, 1863, while from home, I was myself seized with general pains, fever, sore throat, and great prostration. I did not get home until eleven o'clock, and all next day I was very ill in bed with the same symptoms, but there was no rash. Suspecting that I had scarlatina, I sent for a medical friend to advise me as to sending away my only child, but, by the time that he arrived, late in the evening, I was so much better that he gave a decided opinion that my attack was not scarlatina, and next morning, as I was able to get up and attend to my duties, I believed that he was right, and did not send my child away. I have no doubt now from the sequel, and from what I have seen in other cases, that my attack was scarlatina. I may add that at the time I was much exposed to the disease, that I never had scarlatina before, nor have I had it since, and that for many months after that attack I was very anæmic and out of health. On and after May 16 I saw my child as usual. On the morning of May 20 she was attacked with scarlatina in a malignant form, of which she died on the 27th. The period of incubation in this case could not have exceeded four days.

Case xxiv.—On April 1, 1878, Master P. left school at Wimbledon on the fortieth day of an attack of scarlatina for his home at Brighton. Before leaving, desquamation had to all appearances quite terminated, the feet having desquamated twice. Also he had had repeated carbolic acid baths, and he had left all his infected clothes behind. After reaching Brighton his face and feet desquamated again, and four days after his arrival his mother fell ill with scarlet fever. Here also the period of incubation did not exceed four days.

Cases xxv *to* liv.—The following remarkable history was communicated to me in 1865 by Dr. J. Hogarth Pringle, then at Parramatta, New South Wales, in reference to my papers on the Etiology of Scarlatina, which had appeared in the *Lancet* of the previous year. I quote from his letter:

"In the month of April, 1858, I was surgeon of one of the large steamships, plying between Australia and Suez, in the Royal Mail Service. We left Sydney in April, carrying 147 first-class passengers, of whom upwards of forty were children under ten years of age. We had no sickness on board until one day after leaving Aden, or forty-six days after leaving Sydney, when scarlatina made its appearance, and before reaching Suez (four days) thirty cases had occurred. Now, when we left Sydney there was no scarlet fever there, nor was there any at Melbourne, King George's Sound, Galle, or Aden, the only ports at which we touched. I was most careful to ascertain this on my return passage. But a family on board had up to nearly three weeks before their embarkation resided with friends in Queensland who had scarlatina. None of the family who were on board had at that time contracted the fever; but the light clothing they had worn in the

semi-tropical heat of Queensland had been packed up there for the voyage, and the boxes had not been opened until after leaving Aden, and reaching the terrible summer-heat of the Red Sea, when it was unpacked and again called into use. It was in this family that the two first cases occurred, after an interval of upwards of three months since they and their infected garments had left the house in Queensland where scarlet fever had raged. The rapidity with which the disease was developed in the vessel tends to prove what I think I have been frequently assured of, that the incubatory stage of scarlatina is very short."

This is certainly a most remarkable and telling story bearing on the period of incubation of scarlatina. Presuming that most, if not all, of those attacked on board ship were children, out of rather more than forty exposed, thirty were attacked within four days. At all events, in none of the thirty cases could the period of incubation have exceeded four days; in many it was probably much shorter than this, as they may have contracted the disease from those who first sickened rather than from the originally infected clothes; while in two at least of those first attacked, the incubation-stage seems to have been less than twenty-four hours.

Case lv.—Robert W., aged 44, was admitted into the London Fever Hospital on September 17, 1858, on the fifth day of scarlet fever. On September 8 he went to act for a coachman, who, with his children, were laid up with the disease. He did not sleep in the house, and never entered the sick-room, but late in the afternoon of September 8 the coachman, though ill, came out to speak to him, and gave him a cup of tea out of his hand. On the morning of the 13th Robert W. fell ill with scarlet fever, the rash appearing on the 14th. The period of incubation in this case was four and a half days.

Case lvi.—Thomas B., aged 16, was admitted into the London Fever Hospital on October 15, 1858, on the fifth day of scarlet fever, and on the eleventh day he died. Four and a half days before his seizure he arrived from sea, and went to his mother's house, where scarlet fever was. Three of the family had died of it, and a fourth was not expected to live. Here the period of incubation could not have exceeded four and a half days.

Cases lvii *to* lxxii.—Part of the milk epidemic. See *Cases* 117, 118.

Cases lxxiii *and* lxxiv.—On January 10, 1864, a girl returned to the Sailors' Home at Hampstead from visiting a house where scarlet fever was. She did not take the fever itself, but on the 15th another girl in the home was attacked, and on the 16th a second case occurred. The only discoverable source of the poison was that now stated. In these two cases the period of incubation may have been (though not necessarily) as long as five and six days respectively, but it could not have been longer.

Case lxxv.—On a Tuesday in March, 1878, a young lady, A., sickened with scarlatina at a school at Putney. On the following Thursday a second young lady, B., left the school for her own home, where there was no scarlatina. On the Monday following B. fell ill with scarlatina. The period of incubation was somewhere between four (not less) and six (not more) days.

MILK CASES.

Cases 113 *to* 116.

Communicated by Dr. SHEA, Reading.

Ab., a cowman, had scarlet fever at some time during a period of three weeks before February 25. On that date he entered the service of C. C. On February 25 he began to milk C. C.'s cows, and C. C. and his family drank the milk on that and the following day. On February 27 C. C. felt very unwell, and on February 28 (less than 3 × 24 hours) C. C. and three of his children "were down with scarlet fever."

Cases 117, 118.

Communicated by Sir GEORGE BUCHANAN, M.D., F.R.S., late Medical Officer to the Local Government Board.

On June 9 various people partook of certain cream, which appears from circumstantial evidence to have been the cause of scarlet fever to twelve people who afterwards had the disease. Six others had sore throat, apparently related to the same cream, at the same time. All fell ill between June 11 and June 14. Laura (*Case* 117), lady's-maid, was taken ill with sore throat on June 11, two days after the dinner party. She had a slight rash on June 14, five days after the dinner party. One guest (*Case* 118), who partook of the cream on June 10, fell ill with scarlet fever on June 14.

The following are Dr. Murchison's notes of three of the cases belonging to this series:

Case viii.—On June 13, 1875, I was consulted in the case of Lady A., aged 70, who had a typical scarlatina rash, with sore throat and redness of the fauces; pulse 96; temp. 101·5° Fahr. She had never had scarlet fever before; but her daughter had had it when over fifty years of age. On June 9 Lady A. had dined out at 8 P.M., returning home about 11 P.M. Of the sixteen persons who sat down to dinner, eight were attacked within five days with scarlet fever, which there were good reasons for attributing to infected cream. (See Dr. Buchanan's report: 'Reports of Medical Officers of Privy Council,' New Ser., No. vii, 1876, p. 72.) In the forenoon of June 11, Lady A. began to have fever and sore throat. In this case the period of incubation seemed to be somewhere between thirty-four and forty hours.

Cases ix *and* x.—The Hon. Mr. and Mrs. B., aged respectively about 50 and 40, both dined with the same party as Lady A., on June 9, 1875. Both were taken ill with scarlet fever early on June 11, and on June 19 I saw them both in consultation, with great enlargement of the cervical glands and secondary fever. The latent period in both cases was probably somewhat between thirty-four and forty hours.

Cases 119 *to* 126.

Dr. AIRY's Report to the L. G. B. on an Outbreak of Scarlet Fever at Fallowfield, dated December 13, 1879.

A remarkable outbreak of scarlet fever occurred at Fallowfield, three miles from Manchester, in July—August, 1879; 35 persons in 18

families were attacked within a period of one month; of these 24 were attacked between the morning of August 3 and the evening of August 4, a period of twenty-four hours. The infection was contained in the milk distributed from a dairy (D). Dr. Airy considered that his investigation rendered it highly probable (1) that the milk was infected through the agency of one of the milkers, a man who lived in a small ill-ventilated house in which his grandson passed through an attack of scarlet fever (this boy was taken ill at the beginning of July); (2) that a specially intense contamination of the milk took place on the morning milking on August 2, but that on one or two previous days it was contaminated in a less degree; (3) that the period of incubation in the majority of cases was forty-eight hours. The following instances are given:

Case 119 (No. 11 in Dr. Airy's Report).—E. B., a female child, returned from an out-of-the-way residence in the country, where scarlet fever was untraceable, to her home two miles from Fallowfield on August 1. On August 2 she went to D. and had a draught of milk. There were smart premonitory symptoms on the evening of August 3, rash and fever on August 4. Dr. Thorburn, who attended her, wrote, "The period of incubation can have been little over thirty-six hours."

Cases 120, 121 (Nos. 21 and 22 in Dr. Airy's Report.)—"Two boys, aged 14 and 16, returned from school at Wolverhamptom, where there had been no recent scarlet fever, on Friday, August 1. On Saturday and Sunday, August 2 and 3, they were at Fallowfield, and drank milk from the dairy D. On Monday, August 4, they left for Scotland, and both suffered from diarrhœa that night. On Tuesday, August 5, the eldest boy had a rash. The fever was not fully developed in these cases, but they were very like some others in the same outbreak, and probably depended on the same cause."

Cases 122 *and* 123 (Nos. 14 and 15 in Dr. Airy's Report), aged respectively 22 and 15 years, could not have partaken of the infected milk after August 2, as they left home at 2 P.M. on that day, had sore throat in the night, August 3—4, and developed symptoms of scarlet fever on August 4 at Pwllycrochan in North Wales.

Case 124 (No. 26 in Dr. Airy's Report), aged 6, also left home at 2 P.M. on August 2, and developed scarlet fever on August 4 in Scotland.

Cases 125 *and* 126 (Nos. 17 and 18 in Dr. Airy's Report), aged respectively 10 and 11 years, left home on the morning of August 4, and were taken ill on the evening of that day at Coventry.

The following table shows the ages, date, and nature of attack in the remaining cases in which infection is believed to have been due to the milk:—

No. of case in Dr. Airy's Report.	Age.	Date of attack.	Nature of attack and notes.
5	5½	Aug. 3rd	Scarlet fever.
6	8½	„ 3rd	
7	7	„ 3rd	Diarrhœa and vomiting; severe scarlet fever.
8	8	„ 3rd	
9	12	„ 3rd	
10	13	„ 3rd	
12	12	„ 4th	Attacked with scarlet fever in the morning; had complained of sore throat the previous evening.
19	15	„ 4th	Scarlet fever; sore throat the previous evening.
13	25	„ 4th	Attacked in the morning with sore throat; scarlet fever.
16	3	„ 4th	Diarrhœa and vomiting; severe scarlet fever.
20	11	„ 4th	Scarlet fever.
23	7	„ 4th	Sore throat; feverish.
24	3	„ 4th	Scarlet fever.
25	4	„ 4th	
27	(?) 12	„ 4th	
28	6	„ 4th	
29	5	„ 5th	
30	Adult	„ 5th	
31	8½	„ 6th	Sore throat.
32	5	„ 7th	

The symptoms which accompanied the onset of the disease, Dr. Airy states, were in many cases so remarkable as to lead the medical men who attended them to believe that there must be something exceptional in the cause or mode of infection. Not only was there frequent vomiting, but also severe and continued diarrhœa; indeed, in some of the persons attacked diarrhœa was the most prominent and almost the only symptom, and in one of the earliest cases (not included in the above table), which occurred in an adult and did not show full febrile development, it was remarked that the symptoms were more those of irritant poisoning than of scarlet fever. There was, however, no doubt at all as to the real nature of the disease in other cases, which, with similar symptoms of irritation of the alimentary canal, presented also all the characteristics of scarlet fever.

Cases 127 *to* 134.

Memorandum addressed to the L. G. B. by Mr. W. H. Power on Epidemic Scarlatina and Sore Throat in Wimbledon and Merton (June 14, 1887).

To the Memorandum is appended a report by Mr. Cooper, Inspector of Nuisances, Wimbledon.

During the week following Christmas Day there was a sudden outburst of scarlatina and throat illness amongst the consumers of Mr. B.'s milk, and such persons continued to be attacked in increasing numbers till January 1, when the epidemic may be said to have ceased, so far as Mr. B.'s customers were concerned, his supply of milk to this

district having been stopped on December 31, after the completion of the morning delivery.

From first to last in this epidemic, *i. e.* from December 23 to January 15 following, there appear to have been 545 cases of scarlatina and throat illness; of these 493 occurred amongst the consumers of Mr. B.'s milk, being 90·5 per cent. of the total number of cases that came under notice. The total number of persons taking Mr. B.'s milk was 1437, so that over one third were attacked. Households suffered more severely the larger the amount of milk taken.

There were amongst Mr. B.'s customers 11 cases on December 26, 38 cases on December 27, 46 cases on December 28, 67 cases on December 29, and 102 on December 30, after which the number of cases declined, and in one day, from the 1st to 2nd January, fell from 76 to 16. In another eight days, notwithstanding some cases in houses previously invaded, and a few households not supplied by Mr. B., the epidemic was at an end.

The following table contains particulars of eight cases in which persons attacked had only exceptionally partaken of Mr. B.'s milk a short time before falling ill. In these cases the incubation period varied from a little more than one to five days.

No. of case.		Remarks as to taking Mr. B.'s milk.	Date of taking the milk.	Date of first being attacked.	Probable time of incubation.
127	Mr. N.	Returned at tea time	Dec. 28th	Evening, Dec. 30th	2 days.
128	Mr. S.	Returned in the morning	„ 28th	„ „ 31st	3 „
129	Child T.	Spent day in Merton	„ 30th	„ „ 31st	30 hours.
130	Child P.	Returned	„ 30th	Night, Jan. 2nd	3 days.
131	Child W.	Spent day in Merton, and drank quantity of milk	„ 30th	Jan. 1st	2 „
132	Child M.	Drank milk at 2 p.m. on returning after Christmas	„ 28th	Night, Dec. 29th	30 hours.
133	Miss D.	Drank glass of milk	„ 28th	Jan. 2nd	5 days.
134	Mr. H.	Ditto	„ 31st	„ 4th	4 „

On January 5 a butcher who was also a dairy-farmer bought two cows of the dairy-farmer who supplied Mr. B. The butcher said he did not milk the cows, but scarlet fever broke out among the consumers of the milk from the dairy supplied by the butcher, viz:

Jan. 7th . . .	3 cases of scarlet fever		and 4 cases of "throat illness."
„ 8th . . .	10 „	„	
„ 9th . . .	3 „	„	
„ 11th . . .	2 „	„	
	18		

Altogether there were 24 cases among the drinkers of the butcher's milk.

The epidemic was very mild; many of the cases did not present distinctive symptoms, but occurred in houses where scarlet fever was

present. Only 26 cases of scarlet fever or sore throat were heard of among persons who were not consumers of Mr. B.'s or the butcher's milk. There was remarkably little evidence of extension by personal intercourse, and in the sudden cessation of the epidemic evidence to the contrary.

Report on certain observed Relations between Scarlatina in various Districts of London, and Milk supplied from a Dairy Farm at Hendon (*Ann. Rep.* of Med. Off. of L. G. B. for 1885, p. 82).

Mr. Power states that on December 16 (the sale of milk from the suspected sheds having been stopped the previous day) some of the milk was given away by the cowmen to people living near the farm; of the families who thus obtained the milk six were invaded, the first case dating from December 20.

Scarlet Fever and the Puerperal State.

Dr. Robert Boxall has directed attention to certain cases published by him in the *Transactions* of the Obstetrical Society of London, vol. xxx, which contain data as to the duration of the period of incubation in women during the puerperal period.

Three women admitted in succession into a lying-in hospital, and placed after delivery in the same lying-in ward, were attacked, in the same order, with scarlet fever. The circumstances render it highly probable that they were not exposed to infection until after labour was complete, when they were transferred from the labour to the lying-in ward; in this ward they were attended by the same night-nurse as was in charge of another ward in which a woman was attacked with scarlet fever on April 23, 1884; this woman was removed to a fever hospital on April 25. The dates in the three cases which followed are given in the following table compiled from Dr. Boxall's tables:

No. of case.		Date of admission.	Delivery.			Attacked.				
In this list.	In author's list.		Date.	Hours after 119.	Hours after 120.	Hours after admission to hospital.	Hours after delivery.	Hours after admission to lying-in ward.	After 119.	After 120.
135	x	April 25, 9.55 a.m.	April 25, 1 p.m.	—	—	75	72	70	—	—
136	xi	April 26, 4 a.m.	April 26, 7.10 p.m.	30	—	75	60	58	18	—
137	xii	April 27, 2.15 p.m.	April 27, 4.10 p.m.	51	21	53	51	49	30	12

In another group of cases women who had been exposed to infection for varying periods before admission to the lying-in hospital were attacked after delivery.

(*a*) An unmarried girl (*Case* 138, author's case i) was admitted from a mission home on December 26, 1883, and delivered naturally on the same day; ninety-eight hours after delivery she failed with scarlet fever. The nature of her illness was not at the time, however, recognised, and she was allowed to return to the mission home on January 9, 1884. On January 9 another unmarried girl (*Case* 139, author's case iii) was admitted from the same home, was delivered naturally the same day, and failed with scarlet fever fifty-nine hours after delivery. During December a young woman, F., and her baby had been admitted into the home; on December 18 F. was taken ill, scarlet fever was suspected, but no rash appeared, and the suspicion seems to have been discarded, and F. was allowed to mix with the other inmates on December 24, two days before *Case* 138 left the home for the hospital. Before this, however, this young woman had acted as nurse to F.'s infant. *Case* 139 cleaned out F.'s bedroom while F. was ill, and slept in the next room; she was also in contact with *Case* 138 after her return from the hospital. Another girl, Z. (*Case* 140), was exposed in the same way as *Case* 123 to both F. and *Case* 138; Z. left the home for the hospital on January 13, was delivered that day, and was taken ill on January 19, two days after *Case* 139.

(*b*) A certain midwife on January 26, 1884, delivered a personal friend, three of whose children were at the time convalescent from scarlatina, one of them being in process of desquamation. The mother was not affected, and made a good recovery from her confinement. It was otherwise with three young unmarried women who were residing in the midwife's house expecting their confinement; they all suffered from scarlet fever after admission to the lying-in hospital at the dates shown in the following table. For the five or six days following her friend's delivery this midwife had spent the evening in the infected house; she was fetched to bring each of the girls to the hospital when taken in labour. On each occasion she accompanied them in a cab, and one of them, on the way, she subjected to a vaginal examination to make sure that labour had set in. Each of the patients occupied separate lying-in wards. *Case* 141 was admitted on January 29, *Case* 142 on January 31, and *Case* 143 on January 31. Each was delivered on the day of admission.

No of case.		Duration of exposure before labour.	Onset of scarlatina.	
In this list.	In author's list.		After delivery.	After first day of exposure.
138	i	8 days	98 hours	12 days
139	iii	28 „	59 „	31 „
140	—	28 „	4 days	31 „
141	iv	3 „	74 hours	7 „
142	v	5 „	97 „	10 „
143	vi	5 „	124 „	11 „

Dr. Boxall points out that in the cases in this table in which the infection was received before labour the periods of incubation are

rather longer than in the cases in the preceding table in which infection was received after or during labour.

It may be convenient to add here the facts as to the infants of the 16 women whose cases are recorded by Dr. Boxall. (The Roman numerals are those used by him.)

GROUP I.—Date and mode of infection in mother unknown whether before or after delivery.
- ii. Mother attacked forty-five hours after delivery; child unaffected; suckled throughout.
- ix. Mother attacked fifty-eight hours after delivery; child unaffected; suckled throughout.

Mother infected before labour.—

GROUP II.—Date and mode of infection of mother unknown.
- vii. Died during labour.
- viii. Had scarlet fever first day; died eighth day; suckled one day.
- xiii. Unaffected.
- xiv. Unaffected; suckled for a few days.
- xvi. Still-born.

GROUP III.—Date and mode of infection of mother known.
- i (*Case* 138). Unaffected; suckled throughout.
- iii (*Case* 139). Unaffected; suckled fifteen days.
- iv (*Case* 141). Probably had scarlatina. Died on seventh day. Death preceded by diarrhœa and vomiting two days, and convulsions one day.
- v (*Case* 142). Unaffected; suckled till sixth day.
- vi (*Case* 143). Unaffected; suckled till eleventh day.

GROUP IV.—Mother infected during or after labour.
- x (*Case* 135). Scarlatina about twenty-first day.
- xi (*Case* 136). Unaffected; suckled two months.
- xii (*Case* 137). Unaffected; suckled for seven days.
- xv. Had scarlet fever three weeks after removal to fever hospital. Suckled.

Dr. Boxall's conclusions are:

(*a*) That infants kept at the breast are especially prone to scarlatina, probably from the mere fact of contact with the affected parent,

(*b*) That when scarlatina shows itself in the mother during pregnancy the fœtus may or may not be affected *in utero*.

(*c*) That when the mother receives infection shortly before delivery, the infant more frequently escapes, though it may be subsequently infected.

SMALLPOX.

DR. Murchison, in his paper read before the Society in 1878, after observing that in none of the infectious diseases does the period during which the poison incubates appear to be fixed, adds, "Even in smallpox the latent period is not 'limited with precision,' as stated by Trousseau." The cases received by the Committee afford evidence of slight variation only. The incubation period when the disease is conveyed by inoculation is stated to be seven days, but as in none of the cases received by the Committee was the disease acquired in this manner, the duration of the latent period after inoculation will not be discussed here. In the tables which follow it has been necessary to calculate the period which elapsed between exposure and the first appearance of the eruption,* because in certain cases the date at which the initial symptoms appeared was not recorded.

Incubation Period.

From Table I, which contains all the cases in which the disease was contracted after exposure to infection for a short known period, it will be seen that the shortest period of incubation is shown by Case 59. In this case the period cannot have been more than nine days, and the eruption appeared on the thirteenth day after the first exposure. The history of the exposure in this case is not very fully given, but there appears to be no reason to suspect the general accuracy of the account. In Cases 78 and 79 the initial symptoms were noticed on the tenth day, but the eruption did not appear until after thirteen days, a period which must be considered to be embraced by the average duration. In Case 74 the eruption

* When writing of smallpox it appears to be convenient to restrict the term "eruption" to the true papule, vesicle, pustule, or pock, using the term "rash" for erythema, purpura, or other efflorescence occurring during the initial illness.

is said to have appeared on the twelfth day, and it may be suggested as possible that some previous communication by means of fomites may have been the effective source of infection, although no evidence in that direction was obtained.

TABLE I.—*Cases in which there is evidence that the disease was contracted by exposure for a short known period.*

No.	Interval between exposure and		Circumstances of exposure.	Condition as to vaccination.
	Initial symptoms.	Eruption.		
59	8 or 9	12 or 13	Visited a patient on two days preceding his death	Vaccinated.
74	10	12	Visited a patient on fourth day of eruption	Ditto.
78	10	13	Visited an infected house and removed infected bedding	Vaccinated in infancy.
79	10	13	Ditto	Ditto.
2	11	—	Visited a patient with smallpox	—
91	11	—	Visited a town in which smallpox was prevalent	Imperfect primary vaccination.
1	—	13	Visited an infected house	Vaccinated.
iii	11	14	In same ward, for four hours preceding death, with smallpox patient	—
75	11	14	Visited a house infected with "chicken-pox"	Vaccinated.
83	11	14	Visited a patient on third day of eruption	Vaccinated in infancy.
10	12	14	Fomites	—
61	12	14	Visited a town in which smallpox was prevalent	Vaccinated.
67	12	14	Saw and touched body of child dead of "chicken-pox"	Revaccinated.
82	12	14	Visited a patient on second day of eruption	Vaccinated in infancy.
111	12	14	Slept with a man who had been exposed for three days	Ditto.
114	12	—	Visited house in which resided a person who had been exposed	Unvaccinated infant.
54	12 or 13	—	Pregnant woman exposed to patient in first week	—
110	—	14	In contact with a smallpox patient for a few moments	—
66	12 or 13	14 or 15	—	Vaccinated.
89	11	15	Visited a patient	Vaccinated in infancy.
81	13 or 14	14 or 15	Two visits to a patient on third and fourth days of rash	Ditto.

No.	Interval between exposure and		Circumstances of exposure.	Condition as to vaccination.
	Initial symptoms.	Eruption.		
57	13 or 13½	14 or 14½	Interviews with patient on fourth and fifth days of eruption	Vaccinated in infancy.
101	12	15 or 16	Visited an infected house in same village	—
76	12	16	Interview with smallpox nurse	Vaccinated.
i	13	16	Intimate contact with patient on first day	Vaccinated in infancy.
ii	13	16	Visited a patient	—
87	13	16	Interview with patient with confluent smallpox	Vaccinated in infancy.
103	14	—	Visited a patient in same village on day of initial symptoms	—
112	14	—	Brief contact with infected bedding	—
58	15	17	Visited an infected town	Vaccinated.
70	15	17	Visited by a patient convalescent from "chicken-pox"	Ditto.
85	16 or 17	17 or 18	In an infirmary with a smallpox patient	Vaccinated in infancy.
102	14	18 or 19	Visited an infected house in same village	—
56	20	23	Visited by a patient discharged from infectious hospital	—

Cases in which the date at which the exposure commenced is known may possess a certain value if they show an unusually short interval between the beginning of the exposure and the onset of the disease. Cases of this kind have been brought together in Table II, and it will be seen that only two, or at most three, can be quoted as evidence for a period of incubation shorter than that usually observed. In Case 4 the interval between the commencement of exposure and the initial symptoms was only ten days, but the interest of the case is somewhat diminished owing to the date at which the eruption began to appear not being mentioned; the woman had just been confined, a circumstance which may have had some effect in shortening the period of incubation, and her relations with the sufferer from smallpox were very intimate. In Case 9 the interval between the commencement of exposure and the appearance of the rash was thirteen days, which, as already observed, cannot be considered to be beyond the range of average variation; at any rate, the departure is not sufficiently wide to call for any special comment. In the other case (3) the eruption is said to have appeared ten days after the commencement of the exposure, but it seems not impossible

TABLE II.—*Cases in which exposure commenced at a known date, showing the number of days after commencement of such exposure at which the disease began.*

No.	Interval between commencement of exposure and	
	Initial symptoms.	Eruption.
3	—	10
4	10	—
9	—	13
65	12	14
55	12	15
98	12	15
100	12	15
104	13	—
105	13	—
64	14	—
106	14	—
12	—	16
13	—	16
68	14	17
95	15	—
80	15	17
84	15	17
72	16	—
96	16	—
107	16	—
77	17	20
71	18	20

that the infection may have been contracted at some earlier date, perhaps by means of fomites.

Dr. Birdwood, Medical Superintendent of the Smallpox Hospital Ships of the Metropolitan Asylum Board, in a communication addressed to the Committee expresses the opinion that menstruation complicating the initial illness and producing lumbar pain may account for some of the supposed examples of short incubation periods. "Headache," he adds, "is also a source of error; most of the patients admitted into infectious hospitals are not seen by the reporters until the appearance of the eruption has led to the diagnosis of the disease, so that the dates of initial illness are commonly 'patients' histories.'"

On the whole, the evidence submitted to the Committee appears to render necessary the admission that the incubation period of smallpox may be as short as nine days,

but affords no support to the opinion that it is ever shorter —as short, for instance, as five or six days, periods which have been accepted by some authorities.*

TABLE III.—*Cases in which exposure ceased at a known date.*

No.	Interval between cessation of exposure and	
	Initial symptoms.	Eruption.
97	9	—
80	9	11
71	10	12
73	10	12
72	11	—
95	11	—
86	11	13
63	11	14
92	12	—
96	12	—
69	12	14
14 to 53	—	14
62	13	15
93	15	—
94	16	—

A point of greater practical importance in the administration of the laws regarding public health is to determine whether the true incubation period of smallpox ever much exceeds the average which is generally accepted and acted on

* Dr. Murchison writes (*Trans.*, loc. cit.), "Curschmann, in his recent article on 'Variola' (Ziemssen's *Cyclopædia*, Amer. edit., vol. ii, 1875, p. 341), remarks that the latent period of smallpox is not so constant as is always maintained. In cases where he had been able to fix it exactly it had certainly been most often between ten and thirteen days, but in others it had been as long as fourteen days, or as short as from eight to ten days, while in one it was only five days. Zuelzer also found the period of incubation in certain (nine) cases of hæmorrhagic smallpox to be only from six to eight days. Lastly, the fact that the incubation period of smallpox is far from being fixed was demonstrated by the late Dr. Otto Obermeier, in a memoir containing the largest collection of observations on the latent period of smallpox with which I am acquainted" (Virchow's *Archiv*, Bd. liv). Of eighteen cases in which the actual moment of infection was determined,—

In 1	the incubation period was	5 days.
1	„	6 „
3	„	8 „
1	„	9 „
2	„	10 „
5	„	11 „
4	„	12 „
1	„	13 „

—twelve days. For this purpose we have to consider certain cases in Tables I and III. In the cases in Table III the date at which exposure to infection ceased is known; such cases may afford evidence of unusually long periods of incubation. It is worthy of note, however, that in three only are the facts, as reported, incompatible with an incubation period of twelve days. These are Cases 62, 93, and 94.

In Case 62 the interval between the cessation of exposure and the initial illness was thirteen days. In Cases 93 and 94 the patients were seamen on board an infected vessel, and it is, of course, very possible that the infection may have been contracted from fomites at some date subsequent to the removal of the first recognised case. In the very instructive epidemic at the North Surrey District Schools, described by Dr. F. Wilkinson (Cases 14 to 53), the interval between the cessation of exposure and the appearance of the eruption was in all the forty cases exactly fourteen days.

Table I, however, contains ten cases in which the incubation period, if the histories can be accepted as accurate, must have been distinctly beyond the period usually received. In three of these cases (1, 2, and 87) the interval was only one day longer than usual, and it may be, as Dr. Murchison suggests with regard to one of his own cases, that the period might have been less if the thermometer had been used. Against this hypothesis, however, must be set the fact that the initial symptoms lasted three days, so that the rash did not appear until the sixteenth day, a delay which certainly seems to point to a prolongation of the period of incubation. Objection may be made to Cases 102 and 103 on the ground that the persons attacked lived in the same village as the patients, and that infection may, therefore, have taken place at some date subsequent to the visit to the infected house. However improbable this may seem, the possibility cannot be denied; and it will not be safe to found an argument upon these cases. The evidence for a period of fourteen days afforded by Case 112 is very strong, but perhaps the weightiest instance is Case 58, in which a sailor was attacked fifteen days after leaving an infected port; Case 70 also gives evidence in favour of a period of fifteen days. In Case 85 the circumstances are too involved to afford evidence of first-rate value; and Case 56, which would require us to admit an incubation period of twenty days, stands entirely by itself, and is in other respects exceptional, as will be pointed out below.

Duration of Infectious Period.

The infectiousness of smallpox begins with the onset of the initial symptoms, but it is not at that period so easily contracted as at a later date. In the great majority of the cases here reported the infection was derived from a patient who had the rash fully out, but in a few instances the patient was in an earlier stage.

Cases in which infection was derived from a patient in an early stage.

No. of case.

14 to 53.—These 40 cases derived infection from a case which was isolated in what must have been an early stage of a mild attack of varioloid.

69.—In the ward of a hospital with a patient from the day before until the day after the appearance of his eruption.

97.—Exposed during first three days from initial symptoms.

103.—Exposed for short time to patient day after onset of initial symptoms, and two or three days before rash.

On the other hand, there is some evidence that smallpox becomes progressively more infectious after the date of the initial symptoms. In Case 60 a young woman was exposed on the day the initial symptoms began, and again five and six days later; she had the rash exactly thirteen days after her last visit to the infected person, so that it is probable that she was infected on this day, or on the preceding day, and not during her earlier interview. In Case 90 a man was much with his son from the beginning of his illness until the second day of his rash, when the boy was removed to hospital. Five days later the father visited the son in hospital, and fourteen days after this visit he had the eruption of smallpox. Again, in Case 77 the person infected was in close relation with a patient who was ill with the initial symptoms two days before the eruption appeared; after this date Case 77 ceased to have any intimate relation with the case of smallpox, though she remained in the same house for five days more, and frequented it afterwards; she had the eruption fifteen days after she ceased to live in the same house, and no less than twenty after the day on which she attended on the patient; it is probable, therefore, that she caught the disease not on the day on which she was in close relation with the patient suffering from initial illness, but at a later date when relations were much less close. Again, the dates in Case 68 render it

probable that the woman did not contract the disease from her husband until the second or third day of his eruption.

Dr. Birdwood states that during the early eruptive stage the disease is not particularly infectious, and refers to Case 90 in support of this; he points also to the success which has been attained in preventing the spread of smallpox by the early removal of patients to hospital.

The same authority also expresses the opinion that the period for which infection persists, after the acute illness has passed, is short. "For some years past," he writes, "I have been discharging patients when all the enclosed pocks on the soles and palms have been picked over, and all scales fallen or washed off; this period varies from a fortnight to six weeks or so. In no single instance within my knowledge has infection been attributed to a discharged patient. Certainly desquamation after smallpox, seems to be not infectious."

The cases reported to the Committee afford no conclusive instance of infection derived from a convalescent patient; if the story told as to the mode in which Case 56 was infected can be accepted, and the extremely long incubation which would have to be admitted militates against the correctness of the assumption that all the facts were ascertained, then it would afford an instance of infection after convalescence was completely established, and after discharging from an infectious hospital, and therefore presumably after efficient disinfection of fomites.* Cases 11, 70, and the child J. J. mentioned in the account of 70, appear to have derived infection from a person who had become convalescent. The same is probably true of Cases 104 to 107, though in both these instances the infection may have been caught from fomites.

There is abundant evidence that smallpox may be caught from cases of the modified disease, the true nature of which is only recognised in the light of subsequent events. The epidemic at the North Surrey District Schools (see Case 11) is an instance in point. Examples of the unfortunate consequences of confusing smallpox and chicken-pox are afforded by Cases 70 and 76. Failure to diagnose a severe case of

* Upon this point Dr. Birdwood observes, "The assumption that clothes are properly disinfected is not warranted. The patient may not be infectious on discharge, but he may take his wearing apparel out of pawn a week or so after discharge. Patients' friends, knowing all about sanitary regulations, do sometimes remove moveables immediately the medical man has certified an infectious disease, and before the patient is removed. Then, again, the existence of an extremely modified form of the disease in a young, well-vaccinated member of the family may be overlooked; so that the making up of history is really difficult."

smallpox must be a much less common event, but that such a mistake is liable to be made is proved by Case iii reported by Dr. Murchison; it does not appear that in this instance the failure to make a diagnosis was due to ignorance or inexperience.

The retention and conveyance of infection by fomites is an event the occasional occurrence of which is well known. Dr. Stevenson's case reported below (Case 9) is a good example. Cases 78 and 79 are instances in which the infection was caught, apparently from handling the furniture, &c., during the process of disinfecting a room which had been occupied by a smallpox patient. In Case 112 there was a brief contact with infected bedding. In Cases 9, 76, 110, and 114 the infection was conveyed to a third person by individuals who had been in intimate contact with smallpox patients. In the three first-mentioned cases the infection was probably carried by fomites, but in the fourth it must apparently have been retained in the hair of a nurse employed in a smallpox hospital. Dr. Whitelegge* mentions that during a single small outbreak in Nottingham he met with five other cases clearly traceable to contact with persons who, though themselves escaping, were in free communication with smallpox patients. The infection may also be contracted by visiting a house in which a person has died of smallpox, and viewing the body (Case 67, and perhaps 3).

TABLE IV.—*Cases in which persons were exposed continuously during the period of incubation and early illness (at least), showing the interval from initial symptoms to initial symptoms or eruption.*

No. of case.	From initial to initial.	From initial to eruption	From eruption to initial.	From eruption to eruption.
5	14	—	—	—
6	14	—	—	—
7	19	—	—	—
8	14	—	—	14
97	12	—	—	—
109	—	13	—	10
113	14	—	—	—

* The statement is made in his *Annual Report of the Medical Officer of Health for the Borough of Nottingham*, 1888, to which he has directed attention.

Vaccinia and Variola.

Mr. Frank Colclough has contributed an interesting note founded upon the experience of the Smallpox Hospital Ships of the Metropolitan Board from the time Dr. Birdwood became Medical Superintendent. It would appear from this statement that a very large proportion of persons vaccinated or revaccinated successfully at or shortly before the commencement of exposure to infection escape infection entirely. In some instances, however, on or about the twelfth day the individual suffers from an attack of illness characterised by backache, pyrexia, and other symptoms of fever, and accompanied sometimes by an erythematous rash; recovery occurs in two or three days. This illness is of sufficiently common occurrence to have come to be recognised by the staff as a kind of "acclimatisation fever." In other cases again, in addition to backache and malaise, with or without pyrexia, a few abortive papules appear. Such cases are capable of conveying the infection to susceptible persons (see Cases 117, 118, and 119). Finally, in a small minority of cases a definite attack of modified discrete smallpox occurs.

When vaccination or revaccination fails to prevent infection entirely, it does not appear to have any effect in altering the period of incubation.

The experience at the Smallpox Hospital Ships cannot afford any statistical information as to the effect of vaccination or revaccination performed after exposure to infection has commenced, since only those cases in which the protection thus afforded fails to be complete came to the knowledge of the staff. The returns, however, do indicate very clearly that the course of subsequent smallpox may be, and probably commonly is, very favorably influenced by vaccination or revaccination performed during the first week, at least, after exposure to infection has commenced, and they point to the probability that the severity of the subsequent attack is the less the earlier vaccination is performed. Case 131 affords support to the view that even when performed so late as six days before the appearance of the eruption vaccination may have some influence in causing the subsequent attack of smallpox to be of a mild type. The data, however, are not sufficient to permit of a discussion of this point, which, moreover, lies somewhat beyond the scope of this Report.

Conclusions.

(1) The incubation period of smallpox is commonly twelve days (from exposure to initial symptoms), but is not very infrequently a day more or a day less. It is occasionally only nine or ten days, and sometimes fourteen or perhaps fifteen days.

(2) The period of quarantine ought to be fifteen days; if at the end of that time the person who has been exposed to infection shows no signs of indisposition, and presents no elevation of temperature, it will be safe to conclude that the infection has not been contracted.

(3) Smallpox is infectious from the onset of the initial symptoms, and until all scabs have cleared off, but it is very much more infectious during the height of the active stage of the disease than during the initial illness, so that isolation at the time of the first appearance of the rash may be practised with a considerable expectation that the spread of the disease will thereby be prevented or diminished.

(4) The infection can be carried by and retained in fomites, and in the hair of a person who has been in intimate relations with a smallpox patient.

CASES.

Cases 1 *and* 2.

Communicated by Dr. GEORGE RIGDEN, Canterbury, 1878.

A little girl (*Case* 1) from the country visited a house in Canterbury. She was only a short time in the house. On the floor above the floor in which she was was a case of smallpox. "There was no case of smallpox in the neighbourhood in which she resided, and she could not have had the infection from any other source." The eruption modified after vaccination appeared on this little girl on the fourteenth day, *i. e.* thirteen days after the visit to the infected house.

A clergyman (*Case* 2), upon one occasion only, visited a patient with smallpox. He had initial symptoms on the twelfth day, *i. e.* eleven days after the visit.

Cases 3 *to* 6.

Communicated by Dr. F. A. BEST, Walthamstow.

A. (*Case* 3) returned home on February 6 to attend the funeral of his father, who had died of smallpox on February 1, 1877. A. was re-vaccinated before his return, but did not take, and again on February 7, and the arm took fairly well. The eruption appeared on February 16, and he ran through a modified attack of smallpox (eruption ten days after return home).

A man returned home on January 8, suffering from confluent smallpox. His wife (*Case* 4), just confined, nursed him to his death. The wife was taken ill on January 18th, ten days after her husband's return.

A woman was taken ill with smallpox on January 29; two children (*Cases* 5 *and* 6) were seized on February 12, fourteen days after initial symptoms in mother, and the husband (*Case* 7) on February 17, nineteen days. No statement as to isolation.

Case 8.

Communicated by Dr. F. M. EVANS.

Mrs. T. had several rigors on November 25, 1877, and the eruption on November 28. Mr. T. slept in same bed up to and including November 29. Mr. T. had a rigor on December 9, fourteen days after Mrs. T.'s rigors, and eruption on December 12. No mention of isolation.

Case 9.

Communicated by Dr. A. STEDMAN, Great Bookham.

A. sat up all night December 12–13 with a man. On December 13 he returned home to another village, and slept that night in the same room as a man, J. T., aged 70. J. T. had eruption of smallpox out on December 26, thirteen days after commencement of exposure.

Case 10.

Communicated by Dr. Thos. Stevenson.

Mrs. B., landlady of a lodging, went downstairs on December 31, 1879, to stop a woman who had begun to burn a "dress body" in the "copper" fireplace. This dress body had been worn by a girl aged 9, who resided in another house, and was received into hospital on December 28. The sanitary inspector visited the home on December 29, and the parochial officer fumigated the room occupied by the girl with sulphurous acid gas, and heated the bedding, &c., in the disinfecting chamber to 250° F.; the dress body was not heated. On January 12 Mrs. B. was seen by a medical man at midnight, when she had pyrexia and vomiting. On January 14 the smallpox eruption appeared. Initial symptom twelve days, rash fourteen days after.

Cases 11 *to* 53.

Communicated by Dr. F. Wilkinson, Lewisham.

A girl, X. (*Case* 11), at the North Surrey District Schools, who belonged to a class of forty who were being taught housework, &c., was allowed to go to Kensington to visit her mother who was dying of consumption, and on this occasion met a sister recently laid up with smallpox. Fourteen days after (as was subsequently ascertained by examination of office book) X. was admitted into the Infirmary: she was hardly ill at all, and her card was marked gastric; but when examined more carefully, after a large number of cases of varioloid had occurred, she was found to have three spots "evidently those of smallpox, one in her hair, one on back, and one on inside of thigh." X., while in the Infirmary, occupied a bed between two little boys (*Cases* 12 *and* 13) who had been in the Infirmary for months under treatment for acute rickets and glandular disease of the bowel respectively. Sixteen days after X.'s admission to the Infirmary these two little boys "developed smallpox in its very worst form, and both died." Meanwhile, during the course of one morning, fourteen days after X. had been admitted to the Infirmary (and twenty-eight after her visit to Kensington), all the forty members (*Cases* 14 *to* 53) of the house-work class to which X. belonged were admitted to the Infirmary with what the nurse supposed to be chicken-pox, but which Dr. Wilkinson recognised as smallpox. The forty ranged between fourteen and eighteen years old. The school contained 900 children, besides staff; all were vaccinated on the day the forty sickened, and on the two following days.

Case 54.

Communicated by Dr. Ph. Boobbyer.

F. S., aged twenty-three, married and six months pregnant, was exposed to infection from a smallpox patient in the first week on January 3, and up to noon on January 4. She had initial symptoms—headache, epigastric pain, &c.—on the morning of January 16, after 7 a.m. (twelve days after cessation, and thirteen days after commencement of exposure to infection).

Cases 55 *and* 56.

Communicated by Dr. ARMSTRONG, M. O. H., Newcastle-on-Tyne.

Miss S. applied for engagement as assistant matron to the Newcastle Fever and Smallpox Hospital on January 5, 1872, during an epidemic of smallpox; she was at the hospital about midday, and stayed a few minutes. She visited the hospital again on January 6, staying half an hour. On January 16 she was appointed, and began her duties. She was revaccinated on this day, and on January 21 it was "taking well;" she had a faint cicatrix of infantile vaccination. On January 17, the day after commencing her duties in the hospital, she had nausea and backache, and on January 20 the first spots of smallpox appeared on arms and neck. Eruption discrete; case mild. Did not know of having been exposed to any other source of contagion. Initial symptoms twelve days, and eruption fifteen days after first visit to hospital.

A man was discharged from a smallpox hospital on March 6, 1886, travelled thirty miles to Newcastle, and visited his sister's house, remaining two and a half hours. He went away by train, leaving none of his clothes or other belongings in Newcastle. No subsequent communication took place by letter or otherwise previous to A. B. (*Case* 56) falling ill. A. B. began to feel unwell on March 26, twenty days after her brother's visit, and on March 29 a sparse eruption of smallpox papules appeared. There had not been a case of smallpox in Newcastle prior to this for over half a year (last case notified in July, 1885). A. B. had not recently been outside of Newcastle, and had not been in contact with any other known source of infection.

Case 57.

Communicated by Dr. J. Loane, Whitechapel, with additional notes by Dr. Birdwood.

A sailor returned to London from Lisbon, and slept at a certain house on February 27. He had been ill since February 20, and the eruption of smallpox appeared on him on February 23. On February 28 he was sent to the hospital ship with confluent smallpox. Everybody in the house was revaccinated, with the exception of one man, his nephew (*Case* 57), aged 31 years, vaccinated in infancy, who was in the same room with him from about 6.30 p.m. to 7 p.m. on February 27, and for about ten minutes at 7 a.m. on February 28. The nephew had the initial illness on March 13, in the early morning. The eruption was noticed at 7 p.m., March 14, on forehead and forearm. Discrete smallpox. The house was disinfected with sulphurous acid gas by the sanitary officials.

Cases 58 *to* 90.

Communicated by Dr. BIRDWOOD, Medical Superintendent of the Smallpox Hospital Ships of the Metropolitan Asylums Board.

Case 58.—H. P., a sailor from Sydney, left Port Said after a stay of twelve hours on January 21, 1887, at which date there was smallpox at Port Said. He arrived in London on February 5, and was ill with pain in legs and back and headache an hour after landing. The eruption appeared on February 7, and he was admitted to the hospital ship on February 11. Initial symptoms appeared fifteen days after leaving Port Said.

Case 59.—N. A. visited a man, G. (who sickened with smallpox on March 16, and died on March 22, 1887), on two occasions, March 21 and 22. N. A. had a rash on the body and pain between the shoulders on March 30, nine days after his first visit to the man who died. Smallpox eruption appeared on April 3, and N. A. died of confluent smallpox on April 12.

Case 60.—S. A. J., a young woman aged 20, "engaged" to G., went with him to an entertainment on March 16, 1887 (G. first felt ill at this entertainment), and visited him on March 21 and 22. She had rigor, backache, and headache on April 1, sixteen days after going to an entertainment with G., whom she kissed on parting, and ten days after her last visit to him on day of his death. She had rash on April 4.

Case 61.—M. H., female, visited relations at Stockton-on-Tees, when there was smallpox in the town, on April 22, 1887 (early in May smallpox occurred in this family). On May 4 M. H. suffered from initial illness (twelve days after visit to Stockton), and rash on May 6.

Case 62.—A. H., female, paid a visit from April 22 to April 24 to a relative in a hospital at Portsmouth, in which hospital were two smallpox cases at that time. A. H. had initial illness on May 7 (thirteen days after leaving Portsmouth), and smallpox eruption on May 9.

Case 63.—N. G., male, a Spanish ship-steward, was at Seville from July 17 to July 23, 1887. He went ashore daily, and knew there was "plenty smallpox there." He had headache and pain in back on August 3, arrived in London on August 4, and had smallpox eruption on August 6. Initial symptoms eleven days after leaving Seville.

Case 64.—W. Y. (revaccinated six years before), a clerk at the docks, met N. G. (previous case) daily between August 4 and 8, went with him to a hospital on August 8, and was subsequently to August 4 engaged on the infected ship daily. W. Y. had headache and backache on August 18, fourteen days after first meeting N. G., and ten days after his admission to smallpox hospital. Eruption:—August 23.—"Slight blush in groin." August 24.—"General all over body." August 25.—Admitted.

Case 65.—H. S., a British steward's boy, was at Lisbon from August 17 to 20, 1887. He arrived in London on August 25, had headache and backache on August 29, and eruption on August 31. Initial symptoms twelve days after arrival at, and nine days after departure from Lisbon.

Case 66.—A C., female, on October 14 or 15, 1887, went to a rag-shop in which had worked a man who was admitted to the smallpox hospital ship on October 11. On the same day on the steps of a tramcar she was passed by a man who had scabs on his face. A. C. had headache, backache, and sore throat on October 27, twelve or thirteen days after supposed exposure, and had smallpox eruption on October 29.

Case 67.—S. A. V., female, on October 31, 1887, saw and touched the body of a neighbour's child said to be dead of chicken-pox. She had headache, sore throat, and malaise on November 12, twelve days after touching child, and smallpox eruption on November 14.

Case 68.—A. S., female, aged 31. Her husband returned from Barcelona on January 5, 1888. He had had initial symptoms on January 4, the eruption appeared on January 6, and he was removed to hospital on January 10. A. S. had initial illness on January 19, and eruption on January 22. A. S. had initial illness fourteen days after husband's return.

Case 69.—T. S., male, from January 20 to January 22, 1888, was in

the ward of a hospital with a patient who had smallpox eruption on January 21. T. S. had rigor and pains in the back on February 3, fourteen days after beginning and twelve days after end of exposure to infector, and eruption on February 5.

A girl who had been staying at an uncle's, and there had an illness diagnosed chicken-pox, arrived home on or about January 23, 1888. Her brother, J. J., had convulsions and vomiting on February 2, and smallpox eruption on February 5. R. J., female (vaccinated) aged 21 (*Case* 70), was visited by J. J.'s sister on January 28. R. J. had headache on February 12, fifteen days after the visit, and the smallpox eruption on February 14.

Case 71.—J. B., female (vaccinated) aged 40, attended a smallpox patient at home from February 17 to February 25, 1888. J. B. had backache on March 6, eighteen days after commencement, and ten days after the end of her attendance on the patient. Rash on March 8.

Case 72.—A. W., female (vaccinated) aged 29, visited friends at Burnley, where her young man's sister had smallpox at this time, from February 25 to March 1, 1888. A. W. had vomiting and backache on March 12, sixteen days after arriving at, and eleven days after leaving Burnley. Eruption March 13.

Case 73.—P. F., male (vaccinated) aged 44, left Milan, where there was smallpox, on April 4, 1888. He had headache, backache, and sore throat on April 14 (ten days after leaving Milan), smallpox eruption on April 16, and died on April 24.

Case 74.—H. W., male (vaccinated) aged 44, on April 4, 1888, from 7 to 9 p.m. visited his brother and sister-in-law. The sister-in-law had smallpox eruption on April 1, the brother on April 6. H. W. had backache on the morning of April 14 (ten days after the visit), and had smallpox rash on April 16.

Case 75.—J. C., female (vaccinated) aged 39, on June 7, 1888, from 8.30 p.m. to a little after 9 p.m. visited a house in which a young man was very ill with "chicken-pox." On June 18 J. C. had headache and backache (eleven days after the visit), and early on the morning of June 21 she had smallpox eruption.

Case 76.—K. M., female aged 19, was in the society of a smallpox nurse who had bathed, changed her clothes, and brushed—but not, as was usual, washed—her hair, from 11 p.m. on July 16 to 6 a.m. on July 17. On July 28, in the evening, she had initial symptoms, twelve days after commencement of exposure. Smallpox eruption on August 1.

A nun arrived in London from Paris on October 22, 1889. She was feeling ill at that time. On October 24 the eruption of smallpox was noticed. A probationer (*Case* 77), aged 21 years, who fancied she had been vaccinated in infancy, but had no scars, attended to the nun "the greater part of the day" on October 22. She remained in the convent up to October 27. After that she was sent out to nurse a patient, but returned to the convent daily for dinner till November 8, when she had initial illness. She had the eruption (discrete) on November 11.

A man arrived in London from Gijon, in Spain, on March 3, 1890. He had the initial illness of smallpox on March 5, the eruption on March 9. Two men employed by the Vestry to disinfect his bedding, &c., were at the infected house for about half an hour at 11 a.m. on March 13. One of these men (*Case* 78), aged 23, vaccinated in infancy, had vomiting March 23, pain in the back on March 24, and rash on the

hips on March 25. The pock eruption (discrete) was first noticed on the back on March 26, early in the morning.

The other man (*Case* 79), aged 35, vaccinated in infancy, was sleepy and cold on March 23, and complained of backache and aching limbs on March 24. The eruption (discrete) was first noticed on March 26, twelve pocks on forehead.

Case 80.—A woman aged 35, vaccinated in infancy, attended a smallpox patient who had initial illness on May 11, and eruption on May 14, 1890, from May 13 to 19. Case 81 had initial illness on May 28 in the morning, and the eruption (discrete) on the wrists on May 30.

Case 81.—A man aged 24, vaccinated in infancy, visited the same patient on May 16 and 17. He had initial illness, headache, drowsiness, pains in back and "stomach," on May 30, in the morning. On May 31 he had the eruption (discrete) on the arms and face.

Case 82.—A boy aged 6, vaccinated in infancy, on May 18, 1890, visited a patient who had had initial illness on May 15, and eruption on May 17. The boy had the initial illness on May 30, and the eruption (discrete) on June 1.

Case 83.—A woman aged 19, vaccinated in infancy, visited the same patient on May 19. She had the initial illness on May 30, and the eruption (discrete) on June 2.

Case 84.—A man aged 18, vaccinated in infancy, was in hospital at Lisbon from December 15 to 24, 1890, with "typhoid." Whilst there he heard there was a smallpox patient in the hospital. He had the initial illness (giddy) on December 30, 1890, and the eruption appeared on the abdomen on January 1, 1891.

Cases 85 *and* 86.—A smallpox patient went to an infirmary on February 24, and was removed on February 25, 1891. A patient in that infirmary, aged 47 (*Case* 85), vaccinated in infancy, had the initial illness (sleepy) on March 13, and the eruption (discrete) on March 14. He was removed on March 16. Another patient (*Case* 86) occupied a bed in the same ward as the previous case. He had the initial illness, headache and "like knives in back," on March 27. A rash appeared on the same day, and papules on the forehead on March 29. He died of confluent smallpox.

Case 87.—A potman, aged 29, vaccinated in infancy, served a customer who had confluent smallpox on March 16, 1891, and was a long time with him. The potman had the initial illness on March 29, and the eruption on April 1.

Case 88. *Concurrent smallpox and vaccination.*—A baby, aged 11 months, was vaccinated successfully on April 6 on arrival at the hospital, and returned to her home on the following morning. She had the initial illness (convulsions) on April 17, and the eruption (discrete) on April 19.

Case 89.—A woman aged 43, vaccinated in infancy, visited her daughter ill of smallpox at home on April 17. She had initial illness on April 28, and the eruption on May 2, 1891.

Case 90.—A boy aged 7 years, was ill of smallpox on May 7, and had the eruption on May 9, 1891. He was removed to hospital on May 11. "His father (*Case* 90) was with him during his illness at home. He was not infected then. The father visited his son in hospital on May 16, between 3 and 5 p.m." He had the initial illness on May 28, and the eruption (discrete) on May 29.

Cases 91 *to* 97.

Communicated by Dr. Ed. Walford, M. O. H., Cardiff.

Case 91.—J. P., aged 46, residing at Cardiff, where at that time there were no cases of smallpox, visited Bristol on December 29, 1887, at which date smallpox was prevalent in that city. He did not, to his knowledge, come in contact with any infected person. He had the first symptoms of smallpox on January 9, 1888, eleven days after visiting Bristol, and subsequently a confluent attack ending in recovery. Primary vaccination marks imperfect; not revaccinated.

Cases 92 *to* 94.—H. M., aged 30 (*Case* 92), was a sailor on board ss. J. O. H.; another sailor was landed at Antwerp from this steamship on May 12. H. M. had the first symptoms on May 24, twelve days after the other sailor was landed at Antwerp. He recovered. Imperfect primary vaccination. W. Q., aged 28 (*Case* 93), a sailor on the same steamship, had the first symptoms on May 27, fifteen days after the sailor was landed at Antwerp. He recovered. Imperfect primary vaccination. Ck., aged 20 (*Case* 94), also a sailor on the same steamship, had the first symptoms on May 28, sixteen days after the sailor was landed at Antwerp. He recovered. Imperfect primary vaccination. As the source of infection in the first case was not discovered, and as it is not impossible some bedding or clothing may have been left behind, much importance cannot be attached to the long periods shown by Cases 93 and 94.

Case 95.—J. F., aged 30, was a sailor on ss. L—n, which was at Barcelona, where smallpox was prevalent, from October 1 to October 5. J. F. was ashore during this period. He had initial symptoms on October 16, eleven days after leaving Barcelona, fifteen after arriving there. He recovered. He had never been vaccinated.

Case 96.—M. J., aged 30, a negro, was exposed to smallpox infection while convalescent from scarlatina in a hospital shed from October 23, when J. F. was admitted, until October 27, when M. J. was discharged. M. J. had first symptoms of smallpox on November 8, twelve days after discharge from hospital. Recovered. Never vaccinated.

Case 97.—J. W., aged 16, who was exposed between November 12 and 15 to infection (by a youth who had initial symptoms on November 12), had initial symptoms on November 24, twelve days after infector developed first symptoms. He died. Imperfect primary vaccination.

Cases 98 *to* 103.

Communicated by Dr. Wm. Robinson, Stanhope, Darlington.

Epidemic in a village.—The epidemic was started by a woman who came from Toft Hill; she infected her brother, brother's wife, and a man lodging in their house. The lodger, G. A., was covered with fully developed pustules, many confluent, when first seen by Dr. Robinson on January 28, 1885. The brother, J. S., was taken ill on January 23 with acute pleurisy; the temperature fell on January 24, but rose again, and on January 28 the rash began to appear. Mrs. S. had two or three fully developed vesicles on January 26. These cases recovered, and the house was disinfected on February 23. Mrs. J. P. (*Case* 98), who lived next door to J. S., was in J. S.'s house on January 26 and on January 28. She had initial symptoms on February 7 (twelve days

after first visit), and rash on February 10 or 11. Her husband (*Case* 99) had initial symptoms on February 21 or 22 (fourteen or fifteen days after his wife began), and died March 9. Unvaccinated. J. L.'s daughter (*Case* 100), who lived next door to J. S. on the other side, was in J. S.'s house on January 26 and 28. She had initial symptoms on February 7, and rash on February 10 or 11. W. G. (*Case* 101), who lived a quarter of a mile from J. S., was at J. S.'s house on January 26 only. He had initial symptoms on February 7, and rash on February 10 or 11. Initial symptoms twelve days after single exposure. T. H. (*Case* 102) lived a quarter of a mile from J. S.; was at J. S.'s house on January 26 only. He had initial symptoms on February 9, fourteen days after the visit to J. S.'s house. On February 11 he came out in a red rash all over the trunk like that of scarlet fever, and two or three days later the characteristic spots began to appear. Mrs. B.'s daughter (*Case* 103), who lived 100 yards or more from J. S.'s house, and in another street, visited Mrs. J. P. (98) on February 8. The day after Mrs. J. P. had initial symptoms, and two or three days before her rash. Mrs. B.'s daughter had initial symptoms on February 22 (fourteen days after the visit to Mrs. J. P., which was her only exposure to infection).

Cases 104 *to* 107.

Communicated by Sir George Buchanan, M.D., F.R.S., late Medical Officer to the Local Government Board.

In Dr. Airy's Report to the L. G. B. on the sanitary state of Hull, July 26, 1882, Dr. Mason, M. O. H., gives the following facts as to an outbreak of smallpox in the Infectious Disease Hospital, a wooden structure with a brick annexe used for smallpox patients. At the beginning of January, 1882, the hospital contained fifty patients, nine suffering from smallpox and the remainder from scarlet fever. On January 2 the smallpox patients began to use a trough closet, to reach which they had to traverse the lobby which connected the brick annexe with the main building; at this time sixteen patients (eleven adults and five children) convalescent from scarlet fever were using another trough closet on the opposite side of the lobby. These closets were insufficiently flushed, and their untrapped soil-pipes were united under a washhouse attached outside the building; the pipes had often been blocked, and the closets offensive. Of the sixteen convalescent scarlet fever patients who used the trough closet seven contracted smallpox, viz. two cases (*Cases* 104, 105) on January 15, thirteen days after the smallpox patients began to use the closet referred to, one (*Case* 106) on January 16 (fourteen days), one (*Case* 107) on January 18 (sixteen days). Three other patients who began using the trough closet some days later than those first attacked sickened on January 23, 27, and 29 respectively. Among the remaining twenty-five patients who were not yet convalescent, and used other appliances, no cases of smallpox occurred.

Cases 108 *to* 114.

Communicated by Dr. Arthur Whitelegge, M. O. H. West Riding (formerly M. O. H. Nottingham).

From January, 1886, when the last case of smallpox was discharged from hospital, down to December, 1887, there had been no case of smallpox in or near Nottingham. A family of music hall "artistes" came

from Aldershot to Nottingham on December 5, 1887, and took up their quarters at a private lodging-house. The family consisted of father, mother, a girl aged twelve years, and a boy aged eight. The parents had been vaccinated in infancy, but the children were unvaccinated. Smallpox had been unknown in Aldershot for two years previously, and no case occurred after their departure. They travelled direct to Nottingham. They were probably infected on the journey, but could remember nothing suspicious in the appearance of any of their fellow-travellers. Twelve days after their arrival, however, that is on December 16, the girl (*Case* 108) was taken ill, and the eruption of smallpox appeared on December 19. No medical advice was sought. The patient, who underwent a rather sharp attack of discrete smallpox, was kept in an upper room, nominally visited only by her parents and the landlady. The nature of the disease was successfully concealed from the other lodgers until December 27, the eighth day of eruption. Upon the evening of that day Dr. Whitelegge was informed of the case, and had the child removed to hospital. The other inmates were warned of the danger they had incurred, and all were successfully vaccinated or revaccinated, and among the rest an infant of three months. The girl's brother (*Case* 109) had eruption of (subsequently confluent) smallpox on December 29. This boy was taken ill on December 27; he was probably infected at the very onset of his sister's illness. There was no other source of infection in the town or adjacent country at this time. Another girl living in the house, successfully revaccinated on December 28, had a modified eruption on January 6.

A girl (*Case* 110) came into contact with a smallpox patient for a few moments at a house where she was calling. Fourteen days after this (*i. e.* on the fifteenth day), the only known exposure, she had a slight eruption of modified smallpox. A man whose child was lying ill with smallpox left his home on the disease being diagnosed on the third day of eruption, and slept one night with a friend (*Case* 111). The latter, a man vaccinated in infancy, was taken ill twelve days later (*i. e.* on the thirteenth day), and the eruption appeared in forty-eight hours more. At least five other cases were clearly traceable to contact with persons who, though themselves escaping, were in free communication with smallpox patients.

On February 28, 1888, a boy (*Case* 112), aged 10, broke through the cordon made by the sanitary inspector and his assistant, who were destroying bedding infected by a case of smallpox which had ended fatally on February 25. The boy was immediately driven away, but on March 13 he sickened with smallpox. He was not removed to hospital, but attempts made at isolation within household. On March 27 an unvaccinated baby (*Case* 113) was taken ill with smallpox, and on April 4 the father, vaccinated in infancy, was attacked with smallpox (Normanton, Yorkshire).

On February 5, 1888, an unvaccinated infant, aged 7 weeks (*Case* 114), was taken out to tea with some friends, one of whom had some weeks previously come from her home near Sheffield, where one of her children had died from smallpox. On February 17 the infant sickened with smallpox, subsequently confluent (Altofts, Yorkshire).

Communicated to the Society in 1878 by the late Dr. Murchison.

"*Case* I.—On January 9, 1877, Miss L., aged 3, with three good vaccination marks, sat on the knee of her aunt, Miss S., who was then suffering from headache and febrile symptoms, and was in the first day of what proved to be a typical attack of varioloid. After this Miss L. went home, and did not visit the house of her aunt again; nor was she in any other known way exposed to the poison of smallpox. On January 22 she became cross, lost her appetite, and had fever; and on the 25th a few variolous papules appeared.

"Here the period of incubation was thirteen days. Possibly, had the thermometer been used, it might have been a day less.

"*Case* II.—James A., aged 22, was admitted into the London Fever Hospital on February 20, 1868, ill two days. His attack turned out to be one of varioloid. On February 5 he had visited a friend in Whitechapel suffering from the smallpox, and on February 18 he was taken ill with fever, headache, and lumbar pain, but no vomiting. On February 21 the papules of smallpox appeared.

"Here also the incubation period was thirteen days.

"*Case* III.—On September 10, 1864, Eliza P., aged 27, was admitted into the London Fever Hospital on the fifth day of an attack of variola hæmorrhagica, and died at 10 p.m., four hours after admission. There were no characteristic papules, and the case was mistaken for one of malignant scarlatina, and placed in the scarlet fever ward. On September 21, eleven days afterwards, Ruth C., aged 21, who was recovering from an attack of scarlet fever in the same ward, having been admitted on September 5, on the third day of the disease, was seized with the premonitory symptoms of variola, the eruption of which appeared on September 24. She was desquamating freely when the smallpox set in.

"In this case the incubation period was eleven days."

A Note on Vaccinia and Variola.

Communicated by W. Frank Colclough, B.A.Cantab., M.R.C.S., L.R.C.P.Lond., Assistant Medical Officer, Hospital Ships, Metropolitan Asylums Board.

The influence of recent successful vaccination in modifying smallpox varies, and its results may be classified as follows.

(*a*) *Complete immunity.*

The large number of persons engaged at the hospital ships are all revaccinated at the time of joining, and do not suffer from any form of definite variolous illness. Mr. Moule, the steward, has been kind enough to obtain from the wages book the numbers of the staff employed from June 10, 1884, when Dr. Birdwood joined the ships as Medical Superintendent, to August 27, 1892, and these are—

Men	369
Women	323
	692

This number is exclusive of principal officers, assistant medical officers, and contractor's men who have been employed from time to time.

In Dr. Birdwood's annual report for 1884 he gives details of four cases of smallpox among the staff. Two were ill before he joined the ships, namely, on May 26 and June 8 respectively. The others were—

Case 115.—A. M. G., ward-maid, joined July 7, 1884. Vaccinated July 8, and again on July 15, partially successful; she had only a few spots.

Case 116.—G. W., stoker, called on "Endymion" October 21, 1884, for employment, and was engaged on October 24. He was vaccinated on October 24 (failed) and again on October 31 (successful). Initial symptoms were noticed on November 3, and the eruption on November 5, 1884. He had modified confluent smallpox.

A fifth case was that of Nurse W. (*Case* 122), the details of which are given later.

G. W. is clearly a case of concurrent smallpox and vaccination, but no details at that time were given in the case-books.

Therefore in eight years and two months more than 692 *persons have been constantly exposed to infection, and only* 3 *definite cases of smallpox have occurred among them.*

(*b*) *Smallpox without pocks.*

In some instances, although the vaccination is successful, yet on or about the twelfth day after exposure to smallpox infection a rise in temperature to 38° C. or 39° C. (*i. e.* from about 100° F. to 102° F.), with backache, anorexia, pallor, constipation, and occasionally a rash or erythema, occurs. In two or three days these patients quite recover, and the condition is so common that it is recognised by the staff as a sort of acclimatisation fever.

Dr. Birdwood's present method is to vaccinate every member of the staff, on joining, in one place, and the individual is kept to the shore houses or to the "Endymion" until the vaccination has undoubtedly taken: if the vaccination is unsuccessful, it is repeated on the third or fourth day, and again if necessary at the same interval; after this third vaccination the ordinary duty, whatever it may be, is permitted.

(*c*) *Abortive papular stage.*

Patients admitted with a wrong diagnosis and members of the staff sometimes have a few small papules on the fourteenth day or thereabouts after exposure to infection, but these papules do not advance beyond that stage; good instances are the following:

Cases 117 *and* 118.—Two patients (brother and sister)—M. S., æt. 1½, female; J. S., æt. 3, male—were admitted on June 16, 1892. The eruption in both cases had appeared on June 15, and no history of initial illness was obtainable. The diagnosis on admission was *chicken-pox*. They were both revaccinated at once, and again on June 22; both failed. They were isolated, and no suspicious symptoms occurred until those recorded in the following notes:—M. S., June 27.—"Some papules on face and a few on arms, not shotty, very little raised. T. normal; child peevish; no initial symptoms." J. S., July 6.—"Drowsy during afternoon. At 10 P.M. crying out, and limbs occasionally twitching;

headache, flushed. T. 105° F. July 7.—Punctate rose rash on legs; three small papules on face, apparently new; T. 101° F. "Carbolic soap eruption."

Both patients were discharged apparently well on July 8, 1892, the temperature being normal. Dr. Birdwood, at the time of discharge, went very carefully over these two patients, and found no cause to prevent their leaving; he was not able to make up his mind as to the cause of J. S.'s "malaise;" thought of smallpox without pocks, but finally dismissed that idea.

Case 119.—On July 31, 1892, their mother, æt. 25, was admitted; but could give no source of infection. She had been vaccinated in infancy (three scars, area ·52 sq. in.), not revaccinated. She had the initial illness on July 24, 1892, and eruption on July 28 early, and was admitted to the South-Eastern Fever Hospital on July 30. She had a severe attack of discrete smallpox.

The probability is that J. S. at the time of discharge was suffering from smallpox, which reached the abortive papular stage and infected his mother.

(*d*) *Discrete smallpox extremely modified.*

Case 143 (*see* Table) must have been infected about three weeks after successful vaccination; she had a discrete attack. *Case* 115 is an example of a mild discrete attack in a patient vaccinated, presumably, at the time exposure began. The influence of recent partially successful vaccination is well shown in the following case.

Case 120.—E. P., female, æt. 50, was admitted to the hospital ships on August 2, 1892; she had been vaccinated in infancy, and showed three scars; revaccinated when about thirty years old (failed), and again on July 18, 1892. The patient stated that her medical man was satisfied with the result of the vaccination, and that she had some itching and uncomfortable sensations about her arm some days after the revaccination.

On admission there was the merest traces of pigmentation at the three places; on her discharge on August 27 there was no trace whatever of revaccination. Her history was that she was infected by her husband, who was admitted on July 17, 1892, and died of confluent smallpox on July 23, 1892. His eruption appeared on July 14 in the afternoon, and the patient nursed him until about 9 o'clock in the evening on July 16, when he was removed to S.E. Fever Hospital; and she also slept with him for the two nights after the appearance of the eruption. She had, therefore, been constantly in his company for over two days after the eruption, and also visited him on the ships on July 20, when I myself saw the revaccination places. With this exposure it would be quite justifiable to expect that she would have had, if not a confluent, at all events a severe discrete attack. Her eruption appeared on July 29, and on August 2 it was pustular and very discrete, there being only seven pocks on the face. It rapidly modified, and presented the typical features of variola modified by vaccination. She was not treated with our usual remedies, Ol. Menthol and Pulv. Cretæ Aromat., but I gave her a mixture of dilute nitro-hydrochloric acid, simply as a placebo.

Case 121.—E. P.'s landlady, Mrs. F., had seen Mrs. P.'s husband once or twice *from the door* only of his room during his eruption. She was

revaccinated at the same time as Mrs. P., with just the same result, not completely successful. She attended to Mrs. P. before her removal to the S.E. Fever Hospital on August 1, and was thus exposed for about three and a half days to the eruptive state. She had never had smallpox, and had been vaccinated in infancy only.*

Further, recent vaccination, although unsuccessful, seems to exercise a modifying influence, as the following case shows.

Case 122.—Nurse W., æt. 33, vaccinated in infancy, was revaccinated unsuccessfully on June 9, 13, and 17, 1892. She came to the hospital ships on June 9, 1892, and went on duty on June 17, 1892. The eruption of a slight attack of discrete smallpox, which modified, appeared on June 27.

Dr. Birdwood holds that if well-marked papulation is produced at the site of the vaccination, there is probably protection. The case E. P. seems to be a good instance of the modifying effect, for she was admitted in the absence of Dr. Birdwood, and the appearance of her arm on August 2 appeared typical of vaccination taking, up to the formation of a papule and then aborting. It had an exactly similar appearance to the arm of an assistant medical officer whom I had ample opportunity of examining day by day. He was revaccinated on the morning of his joining the ships by a medical friend in three places; the following are my notes of his case.

Case 123.—Revaccinated on a Friday morning at 9.30. On Saturday, 10 P.M., a small "angry" areola round each vaccination place. On Sunday, 10 P.M., three places papular, not disappearing on pressure, red, and dark red at centre; measurements of areolæ 5 mm. in diameter. On Monday, 10 P.M., no change. On Tuesday, 8 A.M., commencing to disappear. He was revaccinated again that morning in one place (fourth day), and then went on duty. The second attempt was most successful; there was considerable swelling of the axillary glands; the arm itself was swollen and angry-looking, with lymphatics well marked out in inflammatory streaks; on the fifth day of the second revaccination there were five small vesicles; they aborted on the sixth day and never became confluent. On the twelfth day after going on duty he became "very seedy," with pallor, anorexia, slight backache, headache, and general malaise; after a smart purge, and a long drive in the country on the next day, he quite recovered.

In this case there seems to be no doubt that the first revaccination reaching the papular stage and then aborting, together with the second revaccination reaching an early vesicular stage and then aborting, afforded protection; but that he suffered from "smallpox without the pocks" is also, I think, certain.

Dr. Birdwood, in his article "A Theory of Smallpox" in the *Guy's Hospital Reports* for 1891, says on p. 105, when referring to the successive crops noticed both in smallpox and in cases of successive vaccinations; "Similarly vaccination after smallpox infection may result in a pock if done at any time preceding vesiculation." In the few instances, however, in which I have revaccinated patients on their admission, when the eruption has been in the macular and papular stages, the revaccination has failed. The reports of over fifty cases of revaccination (taken from the case-books) in various stages of the eruption

* This case seems to me to be an example of protection due to partially successful vaccination.

coincide with my few instances. Vaccination performed at any time during the incubation period may succeed; and this is true even during the initial illness (see summary of tabulated cases); but the bulk of the evidence that I have been able to gather is against the opinion that vaccination will succeed if done when the eruption has appeared. I can only find one case, namely, *Case* 124 in the tabulated list.

The modifying influence of vaccination within three years is—(*a*) Slight amount of eruption, therefore discrete smallpox. (*b*) Early maturity of the pock, *i. e.* pustulation on the third or fourth day of the eruption, instead of, as Dr. Birdwood teaches, from the eighth to the twelfth day in a typical unmodified case. (*c*) Defective development of the pock, and a great tendency to abort, in diameter 1 or 2 mm. instead of 4 or 5 mm. (*d*) There is also a marked difference in the tint of the areolæ; it approaches the peculiar red of "boiled salt beef." In a fair number of cases I have been able to predict correctly, from this peculiar colour alone, that modification would take place; but it is more frequently present in cases which are modified owing to remote vaccination, when the other characteristics of modification are less marked.

The modifying influence of remote vaccination, *i. e.* after seven years is most difficult to estimate, since smallpox is at times modified in the unvaccinated, and it may be unmodified in the vaccinated.

As a general rule, the modifying influence is gradually lost from the third to the seventh year, and frequently does not exist after the latter period.

In Dr. Birdwood's opinion, all persons exposed to the infection of smallpox should be revacciuated, unless such persons have been successfully vaccinated within the preceding two years.

TABLES OF CONCURRENT VACCINIA AND VARIOLA.

Concurrent vaccinia and variola.

No., &c.	Vaccination.	Revaccination.		Smallpox.		Admitted to S.E. Hospital.	Admitted to Hospital ships.	Date of discharge.	Exposure to infection.	Stage of variola.	Stage of vaccinia.	Remarks.*
		Date.	Result.	Date of initial illness.	Date of eruption.							
Case 124. A. N., male, aged 17	Infancy, doubtful	July 2nd, 1886, at the wharf, by Dr. Birdwood himself, in one place, as he felt doubtful as to the diagnosis	Successful. July 5th, five or six small vesicles close together, making a confluent patch. July 10th, one confluent pustule over whole area, quite distinctly made up of several pustules run together	June 29th (?), initial erythematous rash	July 2nd	Western Hosp., July 1st	July 2nd	Aug. 17th	Other members of family had scarlet fever. No history of smallpox infection	July 2nd, shotty papules on face, wrists, back, arms, and pocks on palate	July 5th, vesicular; July 10th, pustular	*Confluent smallpox.* *Probable date of infection,* June 17th. *Revaccinated* July 2nd. *Eruption,* July 2nd.
Case 125. C. W., male, aged 13	Infancy, three scars	March 12th, 1888, presumably on admission at the ships, but no definite statement	Successful (?). March 21st, the site of vaccination has a confluent patch on it exactly resembling the rest of the eruption	March 11th	March 13th	—	March 12th	May 5th	Slept in the same bed with his brother, who was admitted S. E. H. March 1st, 1888; transferred H. S. March 2nd; date of his eruption Feb. 28th	No eruption on admission, on March 13th, stage not mentioned. March 20th, pustular	—	*Confluent smallpox.* Possibly doubtful case of conc. vac. and variola. *Probable date of infection,* Feb. 29th. *Revaccinated* March 12th. *Eruption,* March 13th.

Case 126. W. J. N., male, aged 6	Feb. 4th, 1890, successful	—	—	—	Feb. 13th	Feb. 13th	Feb. 14th	March 29th	Father admitted on Jan. 31st; eruption Jan. 28th	On admission papular	On admission 3 vaccine vesicles	*Discrete smallpox. Probable date of infection,* Jan. 30th. *Vaccination,* Feb. 4th. *Eruption,* Feb. 13th.
Case 127. A. H. N., male, aged 4	Feb. 4th, 1890, successful	—	—	—	Feb. 11th	Feb. 13th	Feb. 14th	March 29th	Brother of W. J. N.	On admission vesicular	On admission 3 vaccine vesicles	*Discrete smallpox. Probable date of infection,* Jan. 29th. *Vaccination,* Feb. 4th. *Eruption,* Feb. 11th.
Case 128. H. W., female, aged 34	Infancy (stated), no scars	April 19th, 1890, with calf lymph by medical man on her sister's removal	Successful	For some days before April 26th	April 28th	—	April 29th	May 31st	Sister admitted April 19th to S. E. H.; transferred H. S. April 21st; eruption April 16th	On April 30th papular and vesicular	Patient's doctor wrote, "Vacc. took splendidly, 3 large pocks on Apr. 24th (?)." On Apr. 30th 3 large vesicles	*Discrete smallpox. Probable date of infection,* April 14th. *Revaccination,* April 19th. *Eruption,* April 28th.
Case 129. E. J., female, aged 22	Infancy, 6 marks, area 2·38 sq. in.	April 7th, 1891, in one place, when visiting her husband at the ships	Successful	April 9th	April 10th	—	April 16th	May 4th	Husband admitted S. E. H. April 1st; H. S. April 2nd; eruption April 1st	On admission vesicular	Not mentioned; only note is "? scar on discharge"	*Discrete smallpox. Probable date of infection,* March 30th. *Revaccination,* April 7th. *Eruption,* April 10th.

* Taking the incubation period to last for twelve days before the onset of the inital illness in its extreme degree, which usually lasts two days, and therefore fourteen days before the eruption.

No., &c.	Vaccination.	Revaccination.		Smallpox.		Admitted to S.E. Hospital.	Admitted to Hospital ships.	Date of discharge.	Exposure to infection.	Stage of variola.	Stage of vaccinia.	Remarks.*
		Date.	Result.	Date of initial illness.	Date of eruption.							
Case 130. C. H., female, aged 11 months	On April 7th, 1891, at S. E. H., when diagnosis was varicella; successful	—	—	April 17th	April 19th	—	April 25th	June 1st	No mention of source of infection	On admission vesicular and pustular	On admission 2 pustules	*Discrete smallpox. Probable date of infection,* April 5th or 7th. *Vaccination,* April 7th. *Eruption,* April 19th.
Case 131. A. L., male, aged 10	April 20th, 1891; successful	—	—	April 20th	April 25th	—	April 28th	May 23rd	Brother admitted April 15th; eruption April 13th	On admission papular	On admission 4 vesicles	*Discrete smallpox. Probable date of infection,* April 12th. *Vaccination,* April 20th. *Eruption,* April 26th.
Case 132. A. T., male, aged 20	Infancy, 3 scars, area ·53 sq. in.	May 13th, 1891	Successful	May 13th	May 17th	—	May 21st	June 6th	Sister admitted May 14th; eruption May 10th	No note made	On admission 2 pustules	*Discrete smallpox. Probable date of infection,* May 3rd. *Revaccination,* May 13th. *Eruption,* May 17th.
Case 133. H. A., female, aged 52	Infancy, 3 scars, area 1 sq. in.	Jan. 31st, 1892	Successful, 3 places	Feb. 6th	Feb. 8th	—	Feb. 11th	March 11th	No mention made of source of infection	Vesicular	Feb. 12th, scabbing	*Discrete smallpox. Probable date of infection,* Jan. 26th. *Revaccination,* Jan. 31st. *Eruption,* Feb. 8th.

Case 134. M. T., female, aged 23	Infancy, 2 scars, area ·26 sq. in.	Mar. 9th, 1892	Successful	March 14th	March 15th	—	March 21st	April 4th	On March 2nd and 3rd, patient was last attending on her brother, who was admitted at Highgate Hosp. March 3rd, and died of hæmorrhagic smallpox (?) on March 5th	On admission few small scabs; 7 on face	On admission 1 adherent scab	*Discrete smallpox.* *Probable date of infection,* March 1st. *Revaccination,* March 9th. *Eruption,* March 15th.
Case 135. F. M., male, aged 35	Infancy, 1 scar, area ·04 sq. in.	April 11th, 1892	Successful	April 22nd (?)	April 22nd	—	April 23rd	May 17th	Was a patient at the Lond. Hosp. for hemiplegia; a patient from same ward was admitted to ships April 11th; eruption April 10th (in early morning)	On admission few papules	On admission 2 scabs	*Discrete smallpox.* *Probable date of infection,* April 8th. *Revaccination,* April 11th. *Eruption,* April 22nd.
Case 136. G. H. G., male, aged 19	Infancy, 4 scars, area ·5 sq. in.	April 28th, 1892	Successful	April 28th, erythema and petechial rash (well marked on admission)	April 30th	—	April 29th	June 3rd	No source of infection mentioned	On April 30th smallpox ernption commencing on face and chest; minute papules	On discharge, June 3rd, 3 scabs	*Confluent smallpox.* *Probable date of infection,* April 16th. *Revaccination,* April 28th. *Eruption,* April 30th.

* Taking the incubation period to last for twelve days before the onset of the initial illness in its extreme degree, which usually lasts two days, and therefore fourteen days before the eruption.

No., &c.	Vaccination.	Revaccination.		Smallpox.		Admitted to S.E. Hospital.	Admitted to Hospital ships.	Date of discharge.	Exposure to infection.	Stage of variola.	Stage of vaccinia.	Remarks.*
		Date.	Result.	Date of initial illness.	Date of eruption.							
Case 137. B. A. F. H., male, aged 4 months	May 11th, 1892, successful	—	—	None observed	May 18th	—	May 28th	June 29th	Patient from same house admitted May 7th; eruption May 5th	On admission late papular and scabbing	On admission 4 scabs	*Discrete smallpox. Probable date of infection,* May 4th. *Vaccination,* May 11th. *Eruption,* May 18th.
Case 138. A. L., female, aged 11	Infancy, 3 scars, area ·08 sq. in.	June 1st, 1892	Successful, 2 scabs	June 3rd (?)	June 8th (?)	June 12th	June 13th	June 30th	Her brother admitted June 1st; eruption May 27th	On admission late papular, pustular, and scabbing	2 scabs (?) on admission	*Discrete smallpox.* Data not sufficient to estimate time of infection.
Case 139. R. L., male, aged 16	Infancy, 3 scars, not defined in margin	14 days before admission	Successful, one place	June 12th, 1892	June 15th	—	June 16th	July 8th	Brother, admitted June 3rd; eruption June 1st	On admission scabbing, pustules, and abortive papules	On admission scabbing	*Discrete smallpox. Probable date of infection,* June 1st. *Revaccination,* June 2nd (?). *Eruption,* June 15th.
Case 140. M. L., female, aged 17	Infancy, 3 scars, area ·602 sq. in.	June 1st, 1892	Successful, two places	June 7th	June 9th	June 12th	June 13th	July 9th	Sister to A. L.	On admission early pustular	Only note, "Successful in 2 places"	*Discrete smallpox. Probable date of infection,* May 27th. *Revaccination,* June 1st. *Eruption,* June 9th.
Case 141. L. L., female,	May 27th, 1892,	—	—	May 23rd	May 28th	—	May 28th	July 12th	Came in with another	On admission papular	July 7th, 4 deeply stained	*Confluent smallpox. Probable date of infection,* May 14th,

	ful								from same house, and with her half-sister; children in same house had just recovered from "chicken-pox"		site of revacci-nation	27th. *Eruption*, May 28th.
Case 142. S. R., male, aged 10	Infancy, 3 scars, not defined in margin	June 23rd, 1892	Successful	June 25th	June 30th	—	June 30th	July 16th	A sister died from confluent small-pox in the ships on June 26th; eruption June 16th; admitted June 22nd. Another sister came in with patient	On admission papules and modified vesicles	July 1st, one typical vesicle	*Discrete smallpox.* *Probable date of infection*, June 16th. *Revaccination*, June 23rd. *Eruption*, June 30th.
Case 143. A. M. G., female, aged 4	Infancy, 3 scars, area ·74 sq. in.	Jan. 31st, 1892	Successful, three places	March 4th	March 5th	—	March 5th	March 19th	No mention made	On admission papular	On admission 3 pocks scabbing	*Discrete smallpox.* *Probable date of infection*, Feb. 21st. *Revaccination*, Jan. 31st. *Eruption*, March 5th. (Therefore caught smallpox about three weeks after successful vaccination.)

* Taking the incubation period to last for twelve days before the onset of the initial illness in its extreme degree, which usually lasts two days, and therefore fourteen days before the eruption.

No., &c.	Vaccination.	Revaccination.		Smallpox.		Admitted to S.E. Hospital	Admitted to Hospital ships.	Date of discharge.	Exposure to infection.	Stage of variola.	Stage of vaccinia.	Remarks.*
		Date.	Result.	Date of initial illness.	Date of eruption.							
Case 144. W. T., male, aged 16 months	—	—	—	May 10th, 1892	May 12th	—	May 14th	*Death* May 15th	Two other patients from same buildings admitted at same time	On admission vesicular, papular petechiæ	—	The father of this child definitely stated in two letters that because of ill-health the child had not been vaccinated. At P.M. both Dr. Birdwood and Dr. Morrice (A. M. O.) "observed 3 scabs on his arm exactly resembling those of vaccination very recently done."
Case 145. E. S., female, aged 19	Infancy, 3 scars, area ·51 sq. in.	May 9th, 1892 May 21st	Failed Successful	*Not smallpox on admission*	June 2nd	—	May 19th	June 7th	Visited a patient dangerously ill on the ships May 9th. Lives in buildings from which many patients had come	June 2nd, papular; June 3rd, vesicular; June 6th, late papular	No note made	*Discrete smallpox*, extremely modified. *Probable date of infection*, May 20th. *Revaccination*, May 21st. *Eruption*, June 2nd. Infected in the hospital; not suffering from smallpox on admission.

* Taking the incubation period to last for twelve days before the onset of the initial illness in its extreme degree, which usually lasts two days, and therefore fourteen days before the eruption.

Summarising these twenty-two tabulated cases, there are—Four cases of confluent smallpox:—Vaccinated on the day of eruption, one (*Case* 124). Vaccinated one day before the eruption, two (*Cases* 125 and 141). Vaccinated two days before the eruption, one (*Case* 136).

Fifteen cases of discrete smallpox:—Vaccinated thirteen days before eruption, two (*Cases* 139 probably, and 145). Vaccinated twelve days before eruption, one (*Case* 130). Vaccinated eleven days before eruption, one (*Case* 135). Vaccinated nine days before eruption, two (*Cases* 126 and 128). Vaccinated eight days before eruption, two (*Cases* 133 and 140). Vaccinated seven days before eruption, three (*Cases* 127, 137, and 142). Vaccinated six days before eruption, two (*Cases* 131 and 134). Vaccinated four days before eruption, one (*Case* 132). Vaccinated three days before eruption, one (*Case* 129).

The number of cases is obviously not sufficient to make any generalisation upon, but the extremely mild attacks of smallpox which the reports state that *Cases* 139 and 145 had are suggestive.

In two cases (138 and 144), the data are insufficient.

One case (143) must have caught smallpox about three weeks after successful vaccination.

VARICELLA.

THE incubation period of varicella is distinctly longer than that of smallpox, but it is often not easy to say whether any initial symptoms have been present; the eruption, as is well known, comes out in successive crops, usually on three succeeding days, and the onset of the disease must, as a rule, be reckoned to coincide with the appearance of the first spots.

Incubation Period.

In his paper in the *Transactions* already quoted, Dr. Murchison stated that he had notes of only one case showing the incubation period of varicella, and that in that case it was eleven days; he pointed out that this period was shorter than that usually assigned, Thomas giving thirteen to seventeen days, and Trousseau fifteen to twenty-seven days.*

The cases received by the Committee are few in number, and not many of them will satisfy a rigid examination. The cases in which the exposure to infection was for a known short period have been collected in Table I; they are only six in number.

Table I.—*Cases in which the exposure was for a known short period.*

No. of case.	Interval to Initial symptoms.	Interval to Rash.	
26		13	In the company of a patient day after return to school.
12		14	In the company of a patient for two hours day of return to school.
13		14	In same house at school for one night.
30	14 or 15	16 or 17	Visited by a nurse.
14		19	In same house at school for one night.
15		19	„ „ „

* Dr. Murchison adds, "When varicella is produced by inoculation the incubation period appears to be shorter than when the disease is contracted in the ordinary way, just as in the case of smallpox and measles. Thus, of ten cases in which Professor Steiner of Prague inoculated the contents of the vesicle of varicella, eight were successful. Varicella, and not variola, was always produced, and previous vaccination had no influence whatever on the result. In all of the eight children the period of incubation was eight days (*Brit. Med. Journ.*, May 8th, 1875, p. 610)."

The longest interval between exposure and the first appearance of the rash was nineteen days, and the shortest thirteen days. In four instances the exposure began at a known date and continued thereafter, either until the eruption appeared, or for a large part of that interval; these cases are—

Case 5. First symptoms 14, and eruption 16 days after commencement of exposure to a convalescent patient.
„ 6. „ 18 days after commencement of exposure to a convalescent patient.
„ 7. Eruption 16 days after commencement of exposure.
„ 3. „ 18 „ „ „

In all, therefore, we have ten cases in which the date at which the exposure to infection commenced is known. To show the relative frequency on the various days they may be arranged thus:

		13		7		6	15
	26	12		5	30	3	14
	∧	∧		∧	∧	∧	∧
Days	13	14	15	16	17	18	19

In Case 26 it appears to be possible that infection may have occurred a day earlier since the boys were at the same school, though no communication is known to have taken place between them. It cannot, therefore, be affirmed from these cases that the incubation period of varicella is ever less than fourteen days.

In attempting to ascertain the longest interval which may elapse between exposure and the appearance of the rash in the person exposed, some evidence may also be obtained from cases in which the date at which exposure ceased is known; these, fifteen in number, are collected in Table II. In none of these cases did the interval exceed nineteen days, which may therefore be fairly taken to be the maximum period of incubation.

TABLE II.—*Cases in which exposure ceased at a known date.*

No. of case.	Interval to Initial symptoms.	Interval to Rash.	
4		12	Attended infected school.
9		13	At school in which a case, isolated as soon as recognised, occurred.
18		13	„ „ „
11		14	„ „ „
10		15	„ „ „
16		15	„ „ „

No. of case.	Interval to Initial symptoms.	Interval to Rash.	
17		15	At school in which a case, isolated as soon as recognised, occurred.
19		16	,, ,, ,,
20		16	,, ,, ,,
21		16	,, ,, ,,
23		16	,, ,, ,,
24		16	,, ,, ,,
22		17	,, ,, ,,
1		19	Attended infected school.
25		19	At a school in which a case, isolated as soon as recognised, occurred.

In all the cases in Table II except Cases 1 and 4 the infector was isolated as soon as the rash appeared on him. In certain other cases the exposure was continuous, but the date of the appearance of the rash in the infector and in the person infected were noted. In 4 cases (Cases 27, 31, 32, 33) the interval was thirteen days; in 3 cases (Cases 28, 29, 35) it was fourteen days; in 2 cases (Cases 5 and 7) it was sixteen days; in 3 cases (Cases 3, 6, and 34) it was eighteen days; and in 1 case (Case 2) it was nineteen days. These cases, combined with those in Table II, are arranged below; the table shows the intervals between the appearance of the eruption in the infector and in the person infected.

TABLE III.

				24			
	33			23			
	32			21			
	31	35		20			
	27	29	17	19		34	25
	18	28	16	7		6	2
	9	11	10	5	22	3	1
	∧	∧	∧	∧	∧	∧	∧
Days	13	14	15	16	17	18	19

There is also Dr. Whitelegge's statement that in his experience the interval between the first and second cases in a household is usually fourteen days, and his further observation that where exposure is not free at first the interval is often longer. In the outbreak recorded by Dr. Clement Dukes, as originated by the boy E. (Cases 12 to 15), the exposure must have been for a period of less than twenty-four hours. The 4 cases apparently infected by E. were attacked fourteen, fifteen, nineteen, and nineteen days later respectively. It will be noted that the boy first attacked appears

to have been in more intimate relation with E. than the other three.

In one of Dr. Churchill's cases the period may have been as short as twelve days, but may have been with equal probability longer. The extremely short period suggested by the case of the housemaid in Dr. Cayley's case is probably incorrect, the other alternative suggested being possibly the true explanation.

Period of Infectiousness.

The cases collected do not supply much evidence on this head. Dr. Clement Dukes's cases, notably Cases 12, 13, 14, 15, 25, and 26, show that the disease is infectious at an early stage—in fact, practically as soon as its nature can be recognised. Cases 5 and 6 afford evidence that the disease may be derived from a convalescent patient, and Case 30 appears to indicate that the infection may be conveyed by a person who does not suffer; Case 8, also, is probably an instance of the same occurrence.

Conclusions.

(1) The incubation period of varicella is usually fourteen days, but may be a day less or four or five days more.

(2) The infection may be derived from a patient at least as soon as the rash appears.

(3) A convalescent patient may convey the infection to others.

(4) The infection may probably be conveyed in clothes.

CASES.

Cases 1 *to* 4.

Communicated by Dr. CHURCHILL.

A boy, aged 6 (*Case* 1), ceased to go to school on February 24; on February 28 he had pneumonia, and on March 13 chicken-pox came out, nineteen days after ceasing to attend school. The boy's mother came to nurse him from March 3 to March 25. The mother was accompanied by an infant (*Case* 2), on whom the first spots of chicken-pox appeared April 1. A young sister (*Case* 3) who visited the first patient on March 23, and returned to London with the rest of the family on March 25, had first spots on April 11 (eighteen days after commencement of exposure).

A boy, aged 3 or 4 (*Case* 4), attended the same school for the last time on March 11, and had chicken-pox on March 23 (twelve days after ceasing to go to school).

Cases 5 *and* 6.

Communicated by Dr. BEAVAN RAKE.

A boy who had had chicken-pox at a school returned home, several hundred miles, when convalescent; he arrived on December 20, 1877, and on January 3, 1878, a brother (*Case* 5) had premonitory symptoms; the eruption began to appear on the night of January 5 (eruption sixteen days after commencement of exposure). Another brother (*Case* 6) returned to the infected house on December 22, and remained until January 2; the rash appeared on January 9 (eighteen days after commencement of exposure).

Cases 7 *and* 8.

Communicated by Dr. CAYLEY.

A girl was admitted into the Middlesex Hospital with varicella on January 14, 1878; on January 30 the physician's assistant (*Case* 7) who had charge of the case was attacked. Incubation not more than sixteen days. On February 4 the housemaid (*Case* 8) who waited in his room, but who had not been brought in contact with the first case, was attacked—probable contagiousness during period of incubation. Infection may, however, have been conveyed by clothes.

Case 9.

Communicated by Dr. ARTHUR STEDMAN.

Four cases occurred in a school on May 12; their source was not traced. The next case (*Case* 9) occurred May 25 (thirteen days after the first cases).

Cases 10 *to* 26.

Communicated by Dr. CLEMENT DUKES.

Two cases occurred in a master's house in 1874, on March 7 and 8 respectively; the next case (*Case* 10) in that house was attacked on March 22 (fourteen days after the last and fifteen after the first of the two cases).

Two cases occurred in another house on March 10, 1874; the next case (*Case* 11) in that house occurred on March 24 (fourteen days after).

A boy, E., returned to school on September 12, 1877, and sat next to H. for two hours; next day E. was found to have varicella, and was removed from the house at once. H. (*Case* 12) had eruption September 26 (fourteen days after exposure). Another case (*Case* 13) occurred in the same house on September 27 (fifteen days), and two more (*Cases* 14 and 15) on October 1 (nineteen days).

On November 9, 1878, a boy, D., had varicella. The next case in this house (*Case* 16) occurred on November 24; another boy (*Case* 17), who belonged to another house, but sat next but one to D. in form, was attacked on the same day (fifteen days).

On November 15, 1880, a case occurred in Mr. E.'s house, and another on the following day; the next case (*Case* 18) occurred on November 29 (thirteen and fourteen days after); 3 cases (*Cases* 19, 20, 21) on December 2 (sixteen or seventeen days), and one (*Case* 22) on December 3 (seventeen or eighteen days).

Two cases occurred on March 2 and 3 respectively in Mr. T. W.'s house; the next case (*Case* 23) in that house occurred on March 19 (sixteen or seventeen days after), but on the previous day a boy (*Case* 24) living in a different house, but in the same form with the earliest case, had the disease (sixteen days).

On March 12, 1886, C. was found to have varicella, and was isolated. D. (*Case* 25), who had been in the same study with C. on that day, was attacked on March 31 (nineteen days).

B. returned to school on May 14, 1886, and next day spots were found on him; there had been cases at his home. P. (*Case* 26), who was with B. on May 15, was attacked on May 28.

Cases 27 *to* 35.

Communicated by Dr. Squire (also published in his *Essays in Preventive Medicine*, p. 78).

A girl attending a day school had a spot on her lip on May 30, and next day other spots, recognised as varicella; the height of the disease was on June 1 and 2, when she remained in bed. Her younger brother (*Case* 27), who occupied the same bedroom, was ill with chicken-pox on June 12, thirteen days after his sister had the first spot, and ten after the disease was at its height in her. Two elder brothers (*Cases* 28 and 29) had the disease on June 13; "the interval in these cases was probably twelve days."

A girl, aged 3 (nearly), was visited on November 29 or 30 by a nurse attending upon a child with chicken-pox. This girl (*Case* 30) had "signs of chicken-pox" on December 14, fourteen or fifteen days after the visit of the nurse. The symptoms were well marked on December 16. The brother of Case 30, aged 7 (*Case* 31), at home with her, was taken ill on December 27, thirteen days after his sister had the first symptoms, and had the full eruption on December 28.

A boy, aged 7, sickened with chicken-pox on April 13, and was ill with it on April 14 and 15. His two elder brothers returned home from school on April 10, and were much with him up to the time of his illness. Both showed slight signs of the illness on April 23, ten days after the initial symptoms in the younger boy. One of them, the

younger (*Case* 32), had high fever and full eruption on April 26. The elder, aged 16 (*Case* 33), who is known to have had the disease in infancy, showed signs of rash on April 26, but the spots aborted, fading on the third or fourth days without becoming vesicular.

A boy, aged 5½, had the first spots of varicella on March 8, and the full eruption on March 9 and 10. His younger brother (*Case* 34), aged 2, showed spots of varicella in great numbers on March 26, eighteen days after his brother's rash began. This child had begun with whooping-cough about March 10, and Dr. Squire suggests that the presence of the whooping-cough led to a prolongation of the incubation period of the varicella. An infant (*Case* 35), aged 4 months, began to suffer from varicella on March 22, fourteen days after the elder brother began to have the rash. It had whooping-cough about a month later.

Communicated by Dr. ARTHUR WHITELEGGE, Medical Officer to the West Riding County Council.

"I have seen many cases in which the interval between first and second cases in household was almost exactly fourteen days, and I have come to regard this as the normal and usual interval. Sometimes it has been thirteen days, *e. g.* January 1—14, and of course frequently longer than fourteen when exposure was not free at first."

Case 36.

Dr. MURCHISON (*Transactions*, vol. xi, p. 240).

"I find among my notes only one case (*Case* 36) showing the duration of the incubation period of varicella; in that case it was eleven days. Most authorities make it longer than this."

WHOOPING-COUGH.

THE attempt to determine with any precision the true incubation period of whooping-cough must always be surrounded with great difficulty. The duration of the catarrhal stage, during which the symptoms are not characteristic, is uncertain, though as a rule it occupies, probably, about a week; in many cases the onset is insidious, while in others of a more severe type the presence of intercurrent pneumonia at an early date delays the appearance of the paroxysmal cough and whoop for days or weeks. The study of a large number of cases would be necessary in order to eliminate the various sources of error, and this is not here possible, since the cases sent to the Committee are few in number. It has seemed advisable, therefore, to do little more than place on record the histories, in the hope that further material may be accumulated in the course of time.

The cases, so far as they go, support the opinion that the incubation period varies a good deal. Thus in Case 1 the catarrh began five days and the whoop eight days after the commencement of exposure to infection, whereas in Cases 7 and 8 the earliest symptoms of catarrh were not observed until thirteen days after the single exposure to which infection was attributed. Case 6 points to a short period of incubation —about a week.

Case 3 is an example of infection derived from a patient in the early stage. Case 5 is an example of infection conveyed by persons not themselves affected, but in intimate relation with sufferers. In this case, and probably also in the epidemic on board the *Oasis* described by Dr. W. H. Pearse, it seems reasonable to assume that the infective material was carried in fomites.

CASES.

Cases 1 *to* 6.

Communicated by Dr. W. SQUIRE (also published in his *Essays in Preventive Medicine*, p. 82).

Case 1.—A girl, aged 12, was brought home to a family, some members of which had whooping-cough, on July 25; she had spasmodic cough with bronchial râles on July 30, and whooped on August 2—eight days after her return.

Towards the end of August the younger children of a family resident in London began to associate, in the garden of the square in which they resided, with the children of another family which had returned from the sea-side with whooping-cough. After September 2 there was no further communication between the families. One of the children, aged 6 (*Case* 2), of the family first mentioned began to suffer from cough, which had become frequent by September 7, and during the next few days all the younger children began to cough. An elder sister, aged 15 (*Case* 3), who had not been in the gardens but had been a good deal with Case 2, was sent away to an aunt's house on September 9. She began to have a cough on September 13 (four days after leaving home), and the nature of her cough was distinct on September 20 (eleven days after leaving home). Her cousin, 8 years old (*Case* 4), residing in the house, began to have a cough and to be ill soon after, and by September 30 the character of the cough was pronounced (twenty-one days after arrival of Case 3, and ten after her cough became characteristic).

Case 5.—A boy, aged 2, was visited on November 20 by friends who had a child at home with whooping-cough. The boy coughed on November 24, and became seriously ill with pneumonia on November 28. He had recovered from the pulmonary complication on December 8, but the cough persisted, and he whooped on December 15. (His illness began four days after exposure to mediate infection, but the whoop was not noticed until three weeks later.)

Case 6.—A child born on February 10, the day on which it was first suspected that two children in the house had whooping-cough, began to pine after the first week, and to have difficulty in taking the breast; on February 24 there was no doubt that it had whooping-cough, of which it died a few days later.

Cases 7 *and* 8.

Communicated by Mr. F. R. HUMPHREY, London, N.W.

W. H. and G. H. returned from the sea-side on July 23. On July 29 they played with some children for three quarters of an hour in the afternoon. These children were suffering at the time from a severe cough, with sickness when they coughed, relaxed throats, &c., but did not whoop till a week or two afterwards when at the sea-side. This was the only occasion on which the children met. On August 11 W. H. and G. H. showed signs of catarrh. The younger (*Case* 7) was a girl aged 18 months, the elder (*Case* 8) a boy aged 2 years 9 months. The younger one's trouble began with puffy face, swollen eyes, and

great languor; the elder's with running at the nose. The disease ran a mild course. In six weeks from the onset they were sent away to the sea-side for a change, returning in fourteen days with cough, but having lost the whoop. This was the only opportunity the children had of getting the disease.

Communicated by Dr. W. H. Pearse, Plymouth.

Ship *Oasis*, Calcutta to Demerara, with 446 souls, including 43 children (1 to 10 years) and 33 infants (under 1 year); embarked September 2, 1865. On October 25, lat. 27° south, occurred the first case of whooping-cough. The case had ailed since October 21. Cases followed on October 27 (1 case), 29 (1), November 9 (1), 12 (1), 15 (1), 17 (1), 29 (2); December 11 (1). (First symptoms in the first case on fiftieth day after leaving port.)

Ship *Hougoumont*, Plymouth to Adelaide, 1866, sailed June 9 with 336 souls, including 46 children and 5 infants. When sixty-six days out, on August 14, lat. 39° south, long. 2° east, the first and only case like whooping-cough occurred.

Ship *Liverpool*, Calcutta to Trinidad, sailed September 7, 1867, with 532 souls, including 35 children and 9 infants. On October 3 a case like whooping-cough showed; none followed.

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